THE FOUNDRY

For November

Educators and Foundrymen Co-operate

FOUNDRY conferences, such as those held at the State University of Iowa the last of October and at Michigan State college last spring, provide exceptional vehicles for furthering mutual understanding and co-operative effort between engineering educators and the castings industry. Through these gatherings, the engineering faculty learns first hand of remarkable progress constantly being made in the manufacture of cast metals, of the high caliber of men now occupying executive positions in the industry, and of the type of training which will best fit students for future positions of responsibility in foundries.

On the other hand, the foundryman discovers that the engineering educational institution is ready and usually exceedingly anxious to direct its facilities in the service of the industry. He often finds that the college or university has exceptional equipment for certain types of research projects and awaits only the co-operation of the industry to be of tremendous assistance in the march of progress. But most of all, the foundryman is brought to realize the possibilities of engineering schools as sources of trained men for building the manpower of the foundry industry.

A few years ago THE FOUNDRY discussed the coming shortage of trained men in the industry, and suggested as one means of overcoming the difficulty, that each year companies undertake to provide for the future by employing, and providing further training for, a number of engineering graduates. Numerous larger companies have been following such a program constantly and today are in position to reap the benefits. But the number of graduates selected by foundries has been entirely too small with the result that today, the call for engineers trained in foundry practice continues to grow and the supply cannot meet the demand. It is to be hoped that the college and university conferences will result in more jobs for engineering graduates next spring and that the number of men employed will increase steadily.

Dean Francis M. Dawson of Iowa has suggested a further possibility for reciprocity. In addition to the conferences attended by foundrymen, the Dean would like to see further instruction provided for engineering students. He has invited the foundry industry to arrange a week or ten-day program at the university on various phases of castings manufacture and use. Such a short course should interest more boys in the opportunities offered by the foundry industry, and probably would have an exceedingly beneficial effect on many others who in a few years may be in closely related fields. The idea should be well worth the consideration of foundry groups located near our engineering schools.

Lighting Economies

WINTER with its dreary days and fewer hours of daylight always emphasizes the need for more adequate artificial lighting in the majority of foundries. While many reasons may be advanced for a more careful consideration of the lighting problem by foundry managers, two appear paramount. Lighting arguments from both safety and economic standpoints are convincing.

In recent years much attention has been directed toward the safety of workmen in industry and as a result highly satisfactory progress has been made. In the foundry industry the effort has included both safety and good housekeeping, since each is a complement of the other. Adequate lighting most certainly should be a part of any good housekeeping program, if only for the psychological effect upon the workmen. On the other hand, it seems inconceivable not to provide a well lighted plant if any consideration is to be given to a safety program.

There can be no doubt as to the economic advantages of proper lighting in industry. The employe is able to accomplish more work with less physical and mental strain. In the foundry, a reduction in the scrap loss may be expected since the molder can see his work and thus discover any variations in materials or practice. At the same time greater safety not only is desirable from a humanitarian standpoint, but on an economic basis as well.

Consideration must be given to the progress in industrial lighting. What was considered adequate lighting a few years ago would fall far short of that mark today. Modern developments in bulbs and reflector equipment constantly increase lighting efficiency and make possible installations to meet specific illumination needs. Engineers state lighting intensities in most industrial plants can be tripled and the cost of light still would be less than 1 per cent of the cost of the product.

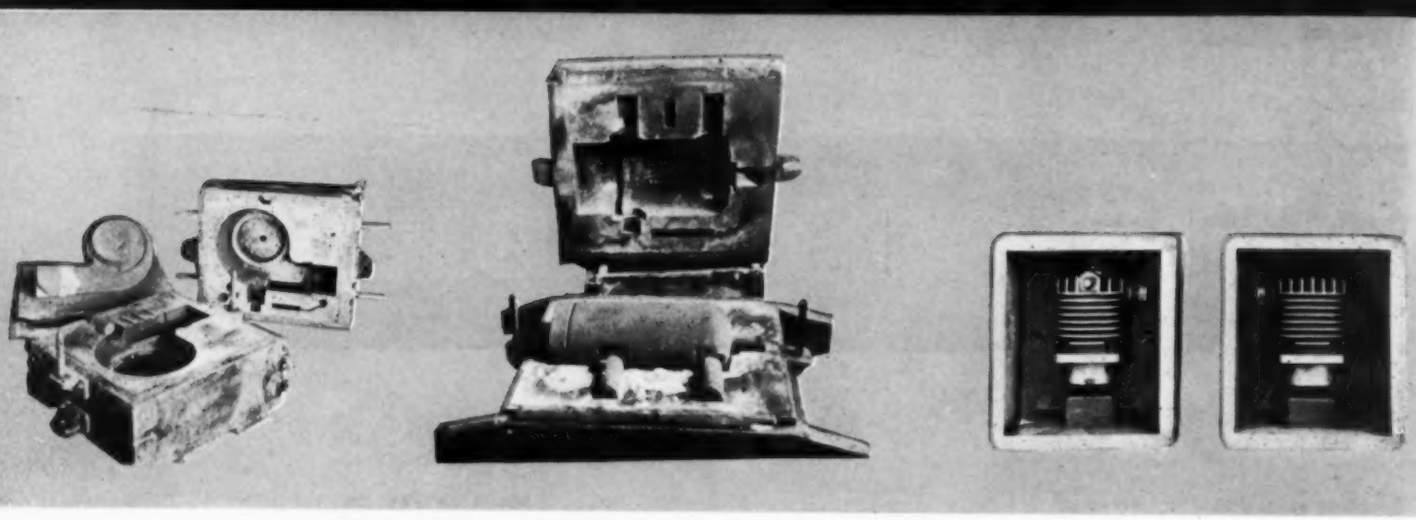


Fig. 1 (Left)—Large casting molded in snap flask. Fig. 2 (Center)—The wood flask has cast iron ends. Fig. 3 (Right)—The pattern with gates attached is mounted in a corebox. The two half cores later are assembled as cope and drag

Features Quality Castings

By PAT DWYER

STEADY increase in business and consequent expansion in plant and manufacturing facilities of the Keen Foundry Co., Griffith, Ind., during the recent period of depression would seem to indicate that there is considerably more than a modicum of truth in the old saying about the better mousetrap. While the basic truth has not changed, modern conditions have introduced some slight modifications in the necessary technique. Whereas formerly the mousetrap maker remained coyly hidden in his sylvan retreat while the clamorous public beat a way to his door, the modern vendor, at least in the preliminary stages of the campaign, has to do some intensive spade work in his attempt to convince customers that his wares possess more than ordinary merit. After he has enlisted the customer's attention to the extent of a trial order he generally can count on further orders without undue expenditure of time or effort.

Price Is Not Principal Factor

Experience has shown that while price is an important factor, probably the most important in instances where quality and surface appearance of the casting do not play an important part, still where these latter factors are paramount, the buyer is not inclined to haggle. Manufacturers take a legitimate pride in the appearance, performance and general utility of the particular object, device or piece of equipment which they offer to the public, therefore they naturally insist on castings that meet their particular and in many instances exacting requirements.

Consideration of this and other related phases of the subject prompted L. E. Keen in 1927 to establish a gray iron foundry and relinquish a position he had held for many years as superintendent of a malleable iron foundry in Hammond, Ind. Optimistic in regard to a field in which the use of gray iron castings gradually is increasing, he felt that the most promising section of that field, and one that would respond most readily to immediate cultivation, was among casting users who are fastidious, who want the best and are willing to pay for it. When, as occasionally happens, a customer rejects a casting for a minor flaw that ordinarily would not be considered, he does not stage an argument in an attempt to have the casting accepted. The customer always is right and the rejected casting goes back into the cupola.

Business Has Expanded Steadily

Starting on an extremely modest scale, the industry immediately under discussion progressed to a gratifying extent during the first 2 years. Then the recent depression descended like a blight on the nation, but despite these conditions the Keen Foundry Co. continued to operate. About 2 years ago the volume of business warranted an addition to the plant. Since that time the plant has been expanded and rearranged on several occasions and still further changes are in prospect. At present the plant is running full time with 50 molders and melting 25 tons of iron per day.

If for no other reason, the plant is interesting as showing a trend toward getting away from thickly congested and highly taxed industrial areas. Griffith, Ind., with a population of less than 2000, lies between Hammond and Gary in the greater Chicago area. Land is cheap and plentiful and the tax rate is infinitesimal as compared to that in the cities. Electric power readily is available at city rates and the town is served by the Outer Belt Line railroad which connects every railroad entering Chicago. Paved roads extend in every direction thus facilitating reception of raw materials and shipment of castings

by auto truck. While the majority of the customers carry on their activities in the greater Chicago district where castings are delivered daily, other customers are located in Detroit and other distant communities. Distances up to several miles no longer constitute a barrier.

In like manner the problem of recruiting a suitable labor supply in small rural and semirural communities, no longer is a problem. With practically every man an automobile owner, employes may live 10, 15, 20 miles or even farther away from the plant. Local young men appreciate the opportunity of securing steady work near home and become expert operators in a comparatively short period. In a modern foundry equipped with a wide variety of mechanical appliances, a long and intensive training period to develop the requisite skill, no longer is necessary. A considerable number of the skilled employes have been in his employ for a number of years.

A site for the new plant deliberately was selected on low ground where waste material could be dumped for an indefinite period and gradually be built up to a predetermined level. Foundation for the original building was set at this level. A spur track was connected to the main line and a roadway was built from the plant site to a main highway in the vicinity. Additional buildings were erected as conditions warranted and at present the filled ground is adequate in area for considerable further expansion. The total plant area embraces 6½ acres.

One Cupola for Two Shops

When the first foundry building was crowded beyond capacity, a second building of equal size was erected parallel to the first, but separated from it by a 30-foot driveway. A connecting link between the two buildings, corresponding to the cross bar in the capital letter *H* houses the two cupolas with their auxiliary elevators and charging floors. The smaller of the two cupolas has not been used for some time, except for charges of special analysis iron. The larger cupola lined to 54 inches supplies all the other metal required in both shops. A monorail carries the ladles from the cupola spout into the foundries at either side and is connected in the center of each building with a monorail line extending from one end of the building to the other. The bull ladles are sent to any designated point, and the molders in the immediate vicinity take the iron in hand ladles to pour the molds. A night gang shakes out castings, cleans the floors and prepares the sand for the following day. Castings are removed to the cleaning room, while the gates, sprues and scrap are taken to the cupola charging floor. The sand is cut over with machines and piled up near the molding machines located close to the walls on each side of the building.

A concrete gangway extends through the center of each foundry building from end to end and the molding floors on either side extend from this gangway to the wall. Three or four floors near one end of one building are devoted to the production of odd jobs, short orders and other miscellaneous types of castings. Molders on these floors are exceptionally skilled mechanics who use loose patterns and ram the sand by hand in wood flasks. In the remainder of the foundry where orders for duplicate castings may run into thousands, steel patterns are mounted on machines made by (*Please turn to page* 76)

Figs. 4, 5, 6 and 7, reading down, illustrate several interesting features in this modern, well lighted coremaking department. Atmosphere is kept clear of smoke by the hoods over the oven doors. Cores are transported on a buggy supported on springs and rubber tired wheels

ITEM	CAT. NO.	ORDER NO.	DATE	DWG.	DESCRIPTION	REQ.	ORD.
400,000 Lb.per.Hr. Deaerating Heater	12784			X-12784	Steel Plate & Riveted (Serial No. 2786)	1	
8'-0" x 12'-0" Storage Tank	12785			X-12785	Steel Plate & Welded (Serial No. 2787)	1	
127 Square Ft. Vent Condenser	12786			X-12786	(Serial No. 2935)	1	
6" x 9" Valve Type Float Box	2223			Z-2223		1	
6" x 12" Valve Type Float Box	2120			Z-2120		2	
Piping & Miscellaneous	12787			X-12787		1	
Indicating Thermometer	P-2908			234-S	Angle type - 9" Scale 40 to 260 F. Range	1	
Testing Kit	P-3833				With complete equipment	1	
Assembly & Test	12787			X-12787	Combined	1	
Clerical & Requisitions							
Lay-outs & Outlines							
Instruction Book	P-26				Deaerating Heater	1	
					These spaces print white and permit insertion of		
					following data on B. M. when issuing orders etc.		
					U.F.A. Order Numbers		
					Quantity of U.F.A's ordered		
					Date of U.F.A. Assembly Orders.		
					Store room check of parts on hand.		
					Pieces of equipment on Contract		
					Date of Works or Assembly order for Contract		
					Works or Assembly order Number for Contract		

CAT. NO. 2036 — 400,000 Lbs. per Hour, Deaerating Heater and Auxiliaries

OUTLINE X-12787 — QUANTITY

TEST PRESS 140 Lb. — DATE

RECORD E-12936 — S. O. 2036 — DATE 7-9-35 — W. O.

ASSEMBLY BILL OF MATERIAL

1 PAGES — PAGE NO. 1

Fig. 3—Assembly bill of material for the job, to be used for costing purposes

Intelligent Planning Cuts Costs

By JAMES J. ZIMMERMAN

TWO methods may be used in obtaining estimated foundry costs:

1. By using an established cost per pound, which includes foundry expense for various weights and grades of castings, and multiplying the estimated casting weights by these prices.

2. By converting the time for the various foundry operations, required for each part, into money values by multiplying the hours by the respective hourly operation rates. To these labor costs the material costs are added. These material costs are made up of the estimated weights by the cost of metal in the ladle or in good castings. To this amount, the foundry overhead and handling charge is applied.

For brevity, functions, documents, papers, etc., will be designated by the following symbols, as in the previous installment of this article in the October issue of THE FOUNDRY:

UFA Unit for assembly and costing purposes
SDE Sales department estimate
BM Bill of material
SCE Shop cost estimate
SO Shop order
TT Returned time ticket
CA Returned shop cost accumulation
ACD Accumulate cost data sheet

When the *SCE* for the *UFA* is completed by the estimators, the accumulated costs will be set forth on *ACD*, Fig 3, and transmitted to the involved sales department for inclusion in the contract *SDE*. A completed *SCE* will show the initials of the people responsible for information given to the estimators. This means that the engineer who prepares the tabulation, will insert his initials for *Items and Weights*, the pattern shop foreman for *Patterns*, etc.

In preparing a *SDE*, (Fig. 1) the following procedure functions successfully but may require modification to suit existing organization set-ups:

1. The sales department prepares in triplicate, a *SDE* with all necessary *UFAs*, costs and data listed and shown on all three copies but with the various overheads, profits and billing price omitted on the second and third copies. *UFAs*, are established by the sales department from past records or according to conditions. After making the quotations, all three copies are filed with the quotations until the order or contract is received.

2. When the order or contract is received, the previously compiled *SDE* sheets are obtained, completely analyzed, and revised if necessary, by the sales department to see that all items are in accord with the contract. Care must be taken to see that the contract does not include items or *UFAs*, not appearing on the original *SDE*, for if such be the case, the equipment cannot be produced within the estimate.

3. After the sales department has approved the estimate and made any necessary revisions or corrections, the three copies are sent with a copy of the contract, approved drawings and other data to the engineering department, or drawing room, for further analysis and checking of the established *UFAs*, and where if any

changes are desired, they are made in conjunction with the involved sales department. The engineering department retains the duplicate copy, which is without overheads etc., sends the triplicate also without overheads etc., to the production department, and transmits the original, with overheads etc., to the involved sales department. These departments make use of these copies for reference and guidance while the equipment is being produced.

4. In addition to distributing the *SDE*, it is the duty of the drawing room to prepare an assembly bill of material, Fig. 3, which lists the established *UFAs*, and send copies of it along with the SDE and outline drawings to the production department.

5. Upon receipt of the *SDE*, assembly *BM*, and outline drawings in the production department, they are analyzed in conjunction with any *SCHs*, and past costs, all of which form the basis for:—

a. Cost control of the separate *UFAs*, and the complete piece of equipment.

b. Establishing operation and other rates of pay.

c. Issuing *UFA*, assembly, general assembly and test orders, so that work will be executed in accord with the predetermined plans of the *SDE*.

d. Issuing part orders so the returned costs will be accumulated in accord with the plans, cost desires and *UFAs*, of the *SDE*.

6. In the drawing room, the *SDE*, forms the basis for issuing *UFA*, *BMs*, and for controlling engineering costs.

Issued by Engineering Department

BMs to cover only a single *UFA*, and never the quantity required for the contract, are issued by the engineering department as rapidly as the detailed drawings, and the *BMs*, themselves are completed for the established *UFA*, or they may be held and issued for the entire piece of equipment. This permits flexibility and enables the production department to schedule the work so as to maintain an even balance in the shops, maintain costs and make deliveries.

If special parts, especially large and complicated, and involving a great amount of pattern, foundry and machine work are desired, the details can be issued on special or preliminary *BMs*, and work started prior to the regular issue of the *UFA*, *BMs*. This possibility is of great importance and enables the shops to make an early start on the work involved on these parts. Such items as are issued on these preliminary *BMs*, will be incorporated on the *UFA*, *BMs* which must be noted to prevent the duplication of *SOs*.

It is not considered essential to present any illustrations of *BMs*, beyond the general or assembly, Fig. 3, which has a particular place in this discussion. Almost all types of *BMs*, are applicable to the routine which has been presented.

After *UFA*, *BMs*, are received in the production department, they are analyzed and *SOs* are issued for the production of parts not on hand or in stock, in a manner consistent with modern practice, which of course includes production planning and provisions for scheduling work through the various departments. By adhering to the assembly *BMs*, work will be executed in accord with the plans which are included in the *SDE*.

It is not necessary to designate any particular type of *TTs*, for use in conjunction with this routine. Practically any means for collecting direct labor will produce results so long as:—

1. They contain only legitimate time.

2. They contain identification part numbers and order numbers for posting to, or accumulating for:—

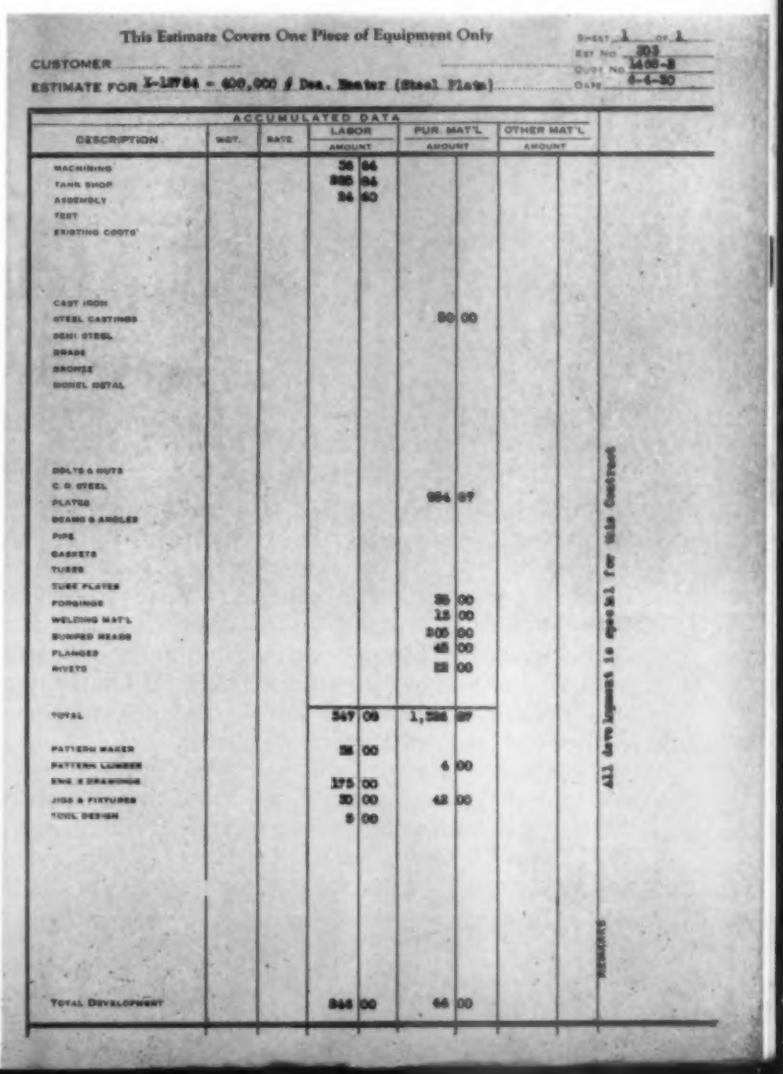
a. Operation costs.
b. Part costs.
c. *UFA*, assembly costs.
d. General assembly costs.
e. Testing costs.

Any type of permanent cost records can be used with equal results, if they are accurate and dependable. However, it is suggested that separate and continuous record cards be maintained for each general assembly or contract cost, each *UFA* cost and for each part cost and that these record cards be posted with the costs of each identical production order. This permits an immediate cost comparison and opens the possibilities for use of average costs for estimates and forms the basis of cost stabilization and reduction.

These record cards, if they are to serve for cost control and cost estimates, should show the following data:—

1. Date, order number and part number.
2. Material, weight, etc., and material value.
3. Labor costs in both (*Please turn to page* 73)

Fig. 4—Method of setting forth accumulated costs and transmitting to the involved sales department


This Estimate Covers One Piece of Equipment Only

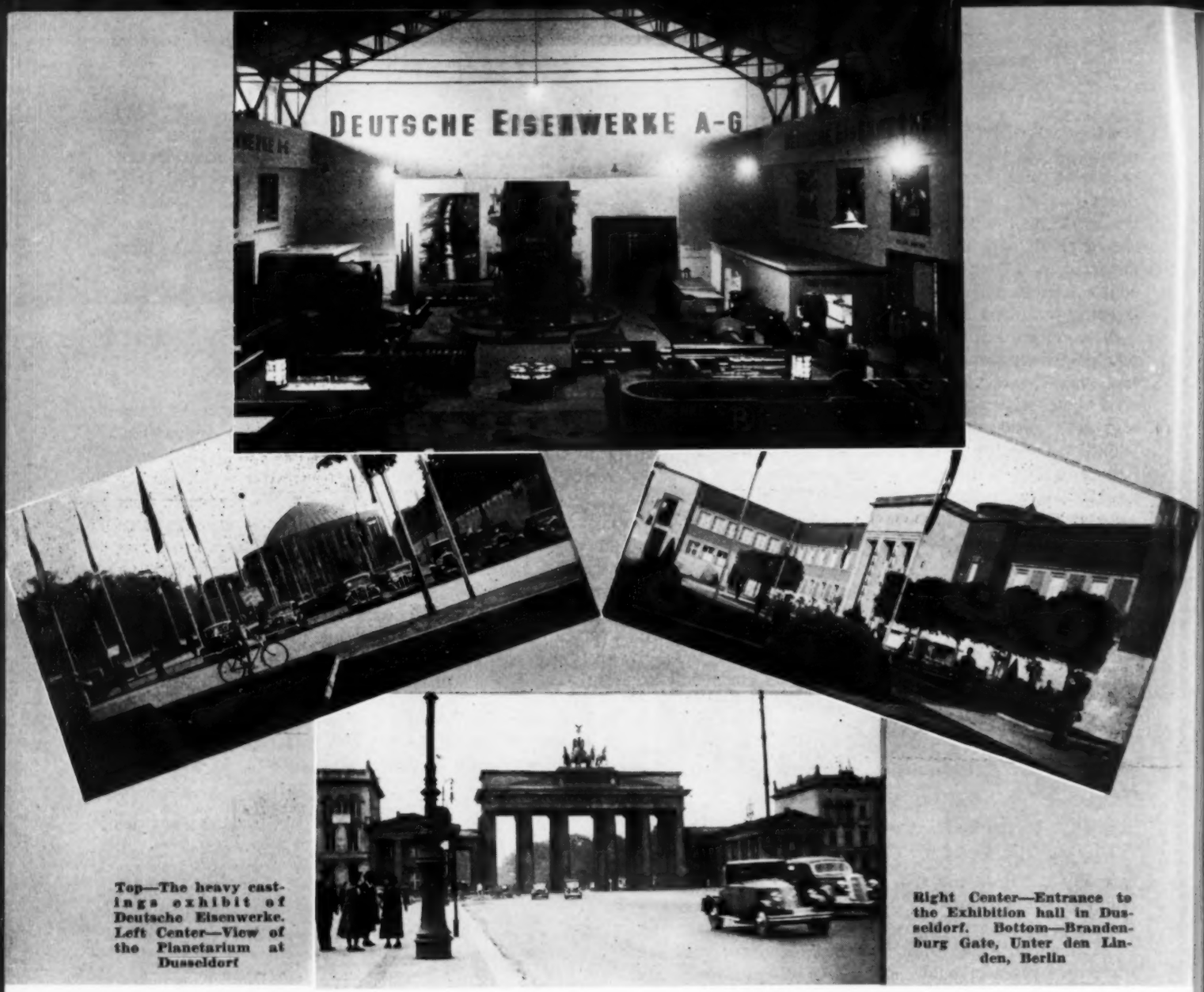
CUSTOMER

ESTIMATE FOR X-12784 - 400,000 # Dea. Heater (Steel Plate)

ACCUMULATED DATA

DESCRIPTION	WGT.	RATE	LABOR AMOUNT	PUR. MAT'L AMOUNT	OTHER MAT'L AMOUNT
MACHINING			36 64		
TANK SHOP			885 94		
ASSEMBLY			24 60		
TEST					
EXISTING COSTS					
CAST IRON					
STEEL CASTINGS				80 00	
MISC. STEEL					
BRASS					
BRONZE					
MONEL METAL					
BOLTS & NUTS					
C. R. STEEL				984 97	
PLATES					
BEAMS & ANGLES					
PIPE					
GASKETS					
TUBES					
TUBE PLATES					
FORGINGS				35 00	
WELDING MAT'L				15 00	
BUMPED HEADS				305 00	
FLANGES				45 00	
RIVETS				22 00	
TOTAL			547 08	1,506 97	
PATTERN MAKER			36 00		
PATTERN LUMBER				6 00	
ENG. & DRAWINGS			175 00		
JIGS & FIXTURES			30 00	42 00	
TOOL DESIGN			5 00		
TOTAL DEVELOPMENT			846 00	66 00	

All data logged is special for this Contract



Top—The heavy castings exhibit of Deutsche Eisenwerke. Left Center—View of the Planetarium at Dusseldorf

Right Center—Entrance to the Exhibition hall in Dusseldorf. Bottom—Brandenburg Gate, Unter den Linden, Berlin

Congress Holds Wide Interest

By VINCENT DELPORT

European Manager, The Foundry

GERMANY, for the first time since international foundry congresses have been regularly organized, was the venue for the Sixth International Foundry Congress and Exhibitions, which was held in Dusseldorf from Sept. 16 to 20. Over 2000 delegates from Germany and from more than 20 foreign countries were present, and, viewing the congress and exhibition as a whole, it can be stated that it will go down as one of the most successful events in recent years.

Dusseldorf is one of Germany's finest modern cities and a leading industrial center, where the German foundry associations have their technical headquarters. Dr. Hjalmar Schacht, the Reich minister of economics, and president of the Reichsbank, came purposely by air to attend the opening meeting. Three morning sessions of specially-selected technical papers were attended fully, and the foundry exhibition was recognized on all sides as being outstanding for its completeness and method of presentation. Among the numerous foreign delegations that attended, the American Foundrymen's association was represented by a small number of prominent members, headed by Thomas W. Pangborn, president, Pangborn Corp., Hagerstown, Md., and by Vincent Delport, in his capacity as European representative of the association.

A comprehensive program of works visits was arranged during and after the congress, and the final session was held in Berlin on Sept. 25. A number of

official receptions and attractive social events was another feature of the program, which also provided for the numerous ladies present.

Is Center of Foundry Research

Dusseldorf is a wide open city of about half a million inhabitants and which stretches along the Rhine. While there are no iron and steelworks or large foundries in Dusseldorf itself, or in the immediate vicinity, the situation of the town, on the border of the industrial district of the Ruhr, has caused it to become the headquarters of the Vereinigte Stahlwerke, the largest steel combine in Europe, and of the German raw steel syndicate and its subsidiaries. Quite naturally, therefore, Dusseldorf has also become the administrative center of the German foundry associations and one of the main centers of foundry research.

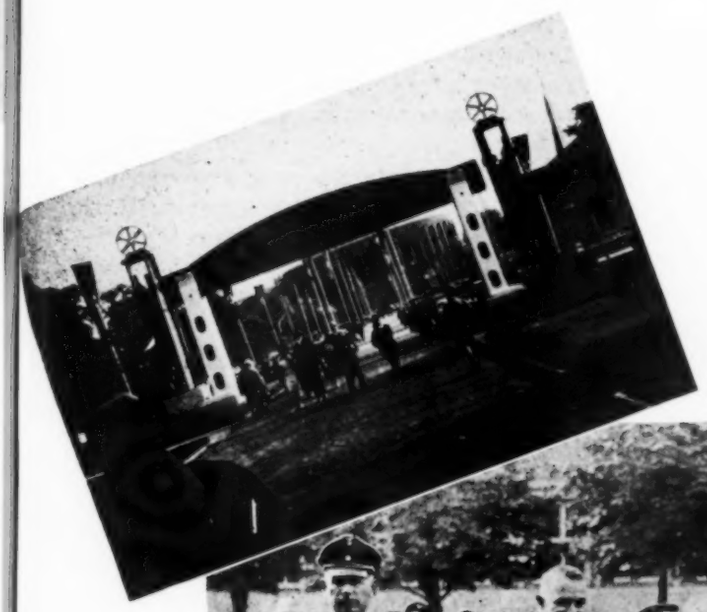
In addition to its industrial and scientific activities, Dusseldorf is a rich city, with wide avenues and beautiful gardens, and it offers many opportunities for sporting events and for the lover of arts. It is one of the few towns in Europe that possesses a planetarium, and it can boast of a number of large and well-appointed exhibition buildings, which were constructed in 1929 on the occasion of the exposition of 1930.

The day previous to the opening meeting—Wednesday, Sept. 16—was partly devoted to the installation and registration of the delegates, who came from the four corners of the world. In the afternoon, a boat trip down the Rhine took the visitors to Duisburg, a large industrial city, an important river port, about 18 miles distant from Dusseldorf. There, the visitors were divided into two groups, one visiting the port, which, although on the river, is one of the most important ports in Germany, and the other visiting the works of Deutsche Eisenwerke, Meiderich, comprising heavy foundries for rolls, ingot molds and big machine parts, and also the works of Eisenwerk Wanheim, another large engineering foundry. On the same day a limited group of visitors saw the foundries of Fried. Krupp at Essen.

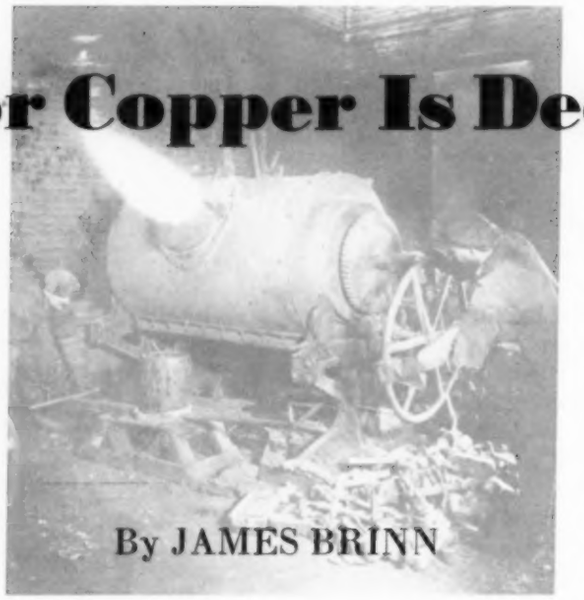
Congress Opens Formally

The formal opening of the congress was held on Thursday, Sept. 17, in the planetarium, which was just large enough to contain the 2000 guests. A novel feature of the event was the presence of a full-sized orchestra, and the proceed- (*Please turn to page* 80)

Left—The avenue leading to the Planetarium and exhibition buildings. Right—Foreign delegates after having laid a wreath on the tomb of the Unknown Soldier in Berlin. From left to right: Tom Makemson (Great Britain), Prof. Pisek (Czecho Slovakia), V. Delport (United States), M. Wertz and M. Baehr (France), Mrs. Bannenberg, J. Leonard (Belgium), W. Bannenberg (Germany), and C. Gierdziejenski (Poland). Photograph by Guido Vanzetti (Italy). Bottom—Dr. Schacht, Reich minister of economics and president of the Reichsbank arriving at the opening meeting. From left to right: Oberbuergermeister Dr. Wagenfuehr; W. Bannenberg, president of the Group of German Foundry associations; J. Leonard, president of the International Committee of Foundry Technical associations; Dr. Schacht; M. Langenohl, president of the Federation of German Foundries



Phosphor Copper Is Deoxidizer



By JAMES BRINN

PHOSPHOR copper, the most widely used deoxidizer in the brass foundry, is obtained in two grades, containing 10 and 14 per cent phosphorus respectively. The 10 per cent grade has the advantage of being easier to calculate in figuring alloy charges. The 14 per cent grade has the advantage of being cheaper per pound phosphorus contained.

Phosphorus renders dull and sluggish metal fluid and lively. It has a greater affinity than copper for oxygen and therefore reduces copper oxide to metallic copper. The oxide, gaseous at the temperature of molten brass, is beneficial in two ways. No detrimental oxide inclusions are formed in the metal as a result of phosphorus addition. In this respect phosphorus as a deoxidizer is superior to aluminum, which may leave films and inclusions of aluminum oxide in the metal. In the writer's opinion, the gaseous oxide of phosphorus forms a thin layer on the surface of the molten metal and envelopes the stream of metal during pouring, thus protecting it against oxidation.

Phosphorus can be used to overcome porosity in bronzes and to permit a certain amount of refining in the brass foundry, as for instance in a charge of borings and turnings. However, all these actions, the result of phosphorus additions, are not instantaneous.

Certain Time Is Required

In this respect, the foundryman can learn something from the ingot maker, who does not pour his metal until he knows it is perfect. There is a great deal of difference between refining a charge of 40,000 pounds metal in a large reverberatory furnace and cleaning a few hundred pounds of dirty and drossy metal in a crucible. Nevertheless, even with small amounts a certain time is required for oxides to be reduced, gases to be removed and nonmetallic inclusions to rise to the surface of the metal.

The action is somewhat similar to that in a glass of carbonated water. At first all the gas bubbles do not rise to the surface. Stirring helps them to come up. Metals occasionally contain so much gas that removal is not practical in one operation in the brass foundry. The required time would be too long. Sometimes that metal is so drossy that despite repeated skimming, black specks of dross continue to appear on the surface of the metal bath. These examples show the importance of the time factor.

Gassy metal does not shrink while solidifying and should be treated as follows: Melt the metal rapidly, adding about ½-ounce of 14 per cent phosphor copper in the bottom of the crucible to each 100 pounds of metal. Stir well and pour a small vertical test bar. If it does not shrink on solidification add another piece of phosphor copper, stir well and pour another test bar. Repeat until the test bar shrinks, an indication that the metal is free from porosity and gas. If the metal is hot enough the castings can be poured. Where the metal is too cold or still contains gas, it should be poured into ingots. Part of these ingots and part new metal are melted for the castings.

Reasons for the presence of gases and porosity in metals include absorption and occlusions reactions between carbon or carbonaceous matter and metal oxides, presence of impurities which generate gas, etc. Although it helps in a number of cases, the treatment with phosphor copper is not always followed by success. If porosity is caused by a reducing gas such as carbon monoxide, a reducing agent such as phosphor copper cannot help. In such a case an oxidizing treatment is required. Another case where the treatment with phosphor copper does not help is when the alloy already contains phosphorus as an alloy constituent.

These alloys usually contain phosphorus in amounts from 0.01 to 1.00 per cent. In many instances castings of these alloys have a rough surface and exhibit a number of blowholes on machining. The following precautions are imperative for obtaining sound castings:

1—Use a sand of high permeability and dust the mold surfaces with plumbago. If necessary, sharp sand can be added to the normally used foundry sand to obtain a higher permeability.

2—Pour the castings at the lowest possible temperature. Use a pyrometer. Otherwise it is difficult to estimate the temperature since the phosphorus renders the metal very fluid.

3—Arrange the gate or gates so that the metal fills the mold quietly.

4—Gate the castings so that the thinnest sections receive the hottest metal.

Importance of these items easily is understood when one realizes that the phosphorus content of these bronzes is from ten to a hundred times greater than in ordinary bronzes. High phosphorus content makes the metal thin and wild, likely to penetrate the in-

terstices between the sand grains. Hence it is necessary to pour cold so that the metal sets quickly and to protect the mold surfaces with a coating of plumbago.

Since moisture and gases easily are trapped in metal containing high percentages of phosphorus it is necessary to use a sand of high permeability and to pour in such manner that no turbulence is set up within the mold. If this is done, all the air, steam, and gases will escape before the metal fills the mold.

The following alloys are taken from specification for bronzes for movable bridges, accepted by the American Railway Engineering association:

Grade *A* specifies a maximum phosphorus content of 1.00 per cent, a maximum tin content of 20 per cent, a maximum content of impurities of 0.50 per cent and remainder copper.

Grade *B* specifies a maximum phosphorus content of 1.00 per cent, a maximum tin content of 17 per cent, a maximum content of impurities of 0.50 per cent and remainder copper.

Grade *C* specifices a maximum phosphorus content of 1.00 per cent, a maximum tin content of 11 per cent, a maximum lead content of 11 per cent, and a maximum copper content of 82 per cent.

Specification No. 65, for phosphor gear bronze, accepted by the Society of Automotive Engineers, shows phosphorus 0.10 to 0.30 per cent, other elements maximum 0.50 per cent, copper 88 to 90 per cent and tin 10 to 12 per cent.

Substitute Nickel for Tin

Considerable improvement in the physical properties of this alloy has been made in the past one or two years by substituting 1.00 per cent nickel for 1.00 per cent tin.

Effect of phosphorus on the physical properties of bronzes is a greater brinell hardness, a higher elastic limit, and, in gear bronzes, such extraordinary wearing properties that these alloys are surpassed by no others. Competition and the trend of the times to use cheaper metals wherever possible have resulted in many applications of other gear material in place of previously used phosphor bronze gears. For worm gearing service no metal can take the place of phosphor bronze.

Composition of the alloy determines the amount of phosphorus that should be added for deoxidizing purposes. This amount depends on the percentage of zinc or other deoxidizing elements in the metal. Phosphorus promotes fluidity to a much higher degree than zinc. In other words a small percentage of phosphorus has the same effect as a large percentage of zinc. However, it is not desirable to add a large percentage of zinc, since that would change the composition of the alloy.

Addition of 0.04 per cent phosphorus, equivalent to 4 ounces of 14 per cent phosphor copper to each 100 pounds of metal, usually is made to the 88 per cent copper, 10 per cent tin, and 2 per cent zinc alloy.

Alloys of the 85 per cent copper, 5 per cent tin, 5 per cent lead and 5 per cent zinc type as a rule require a phosphorus addition of 0.02 per cent or 2 ounces of 14 per cent phosphor copper to each 100 pounds of metal.

Alloys containing 81 per cent copper, 3 per cent tin, 6 per cent lead and 10 per cent zinc, or, 78 per cent copper, 2 per cent tin, 7 per cent lead and 13 per cent zinc require only half as much phosphorus as the 85-5-5-5 alloy. In alloys still higher in zinc the phosphorus should be correspondingly less.

Bronzes containing large percentages of lead are quite sensitive to addition of phosphorus. Two ounces of 14 per cent phosphor copper to each 100 pounds of metal, ordinarily is sufficient for the 80 per cent copper, 10 per cent tin and 10 per cent lead alloy. From 1 to 1½ ounces of 14 per cent phosphor copper should be added to each 100 pounds of the 78 per cent copper, 7 per cent tin and 15 per cent lead alloy. With increasing lead content for example, the alloy containing 70 per cent copper, 5 per cent tin and 25 per cent lead, only about ½-ounce of 14 per cent phosphor copper is needed for every 100 pounds of metal.

Phosphorus Kept Within Reasonable Limits

Phosphorus additions should be made immediately after the crucible has been drawn from the pit. The phosphorus is added only to compensate for phosphorus eliminated during melting and pouring previous heats. The aim is to keep the phosphorus content of the various alloys within limits necessary for proper deoxidation and which have been determined by practical foundry experience.

To reduce copper oxide and to promote fluidity phosphorus is a valuable aid in using red brass borings and turnings in the foundry. No special precautions are required for charges that contain up to 20 per cent borings, provided of course, they are clean. For charges containing from 40 up to 100 per cent borings the melting procedure should be as follows: Place two to three shovels of lump charcoal in the bottom of the pot to provide a reducing atmosphere during the heating period. Borings exhibit a greater surface than ingots, gates and risers to atmospheric oxidation. Add the phosphor copper—about 4 ounces of 14 per cent phosphor copper to each 100 pounds metal—and then the borings mixed with flux. Equal parts of lime and soda ash is a good flux for red brass borings. Borax is used quite frequently. It has excellent fluxing properties, but unfortunately it attacks the crucible to a greater extent than any other flux. Amount of flux depends on the condition of the borings. Clean borings require little or no flux. The usual amount is from 1 to 3 pounds of flux to each 100 pounds of metal.

The metal should be raised to a good heat. Otherwise the impurities are likely to remain suspended. After the pot has been drawn from the fire the metal should be well stirred and skimmed. If the slag is too thin and watery to skim—an exception rather than the rule—a shovel or two of sand should be thrown on to thicken the slag. A vertical test bar then is poured and if it shows a good shrink and later upon breaking exhibits a clean fracture, the metal is fit for pouring castings. *(Please turn to page 74)*

Develops Simplified Gray Iron Cost System

GENERAL lack of any basic records in small foundries for the assembling of data essential to cost information has prompted the Gray Iron Founders' Society Inc., Cleveland, to develop what is termed the "Foundry Business Record." That record is a combination bookkeeping and cost finding system and is in absolute accordance with the Uniform Cost and Estimating System developed two years ago by the society and described in detail in the October and November, 1934 issues of THE FOUNDRY.

It must be borne in mind that there is considerable over-emphasis on the amount of time and clerical help required to handle the additional work, and also the high cost of installation. With this in mind, the "Foundry Business Record," while being low in cost, contains all the required information and is so flexible that it may be expanded as a member of the industry requires additional knowledge of his business. The combining of cost and bookkeeping records greatly simplifies the entire operation, and the use of this method will permit bookkeepers to devote considerable time to handling of other details.

Form Appears on Both Sides

All required information is tabulated on five forms of which Forms 1 and 2 are special journal sheets, and while shown as two forms, one form will show on each side of a single sheet when printed. Form 3 is a combination payroll and distribution sheet. Form 4 is a recapitulation of cost data from general ledger, assembled to give cost of melted metal and departmental overheads. Form 5 is a cost estimate sheet or card for use as described in the text.

Instruction for use of various forms which must be followed carefully are:

Keep Accurate Record on Items

(1) All money transactions being handled through a bank, columns are provided to record such transactions. Deposits are entered under "Debit" columns; customers *"credited"* for their payments under *Acts. Rec.* (Sales) by date as shown in its column and *name* with explanation in their proper columns. Checks drawn on Bank are entered in Credit Column and their numbers noted in the "Check No." columns, showing to whom drawn (under name) with *explanation.*

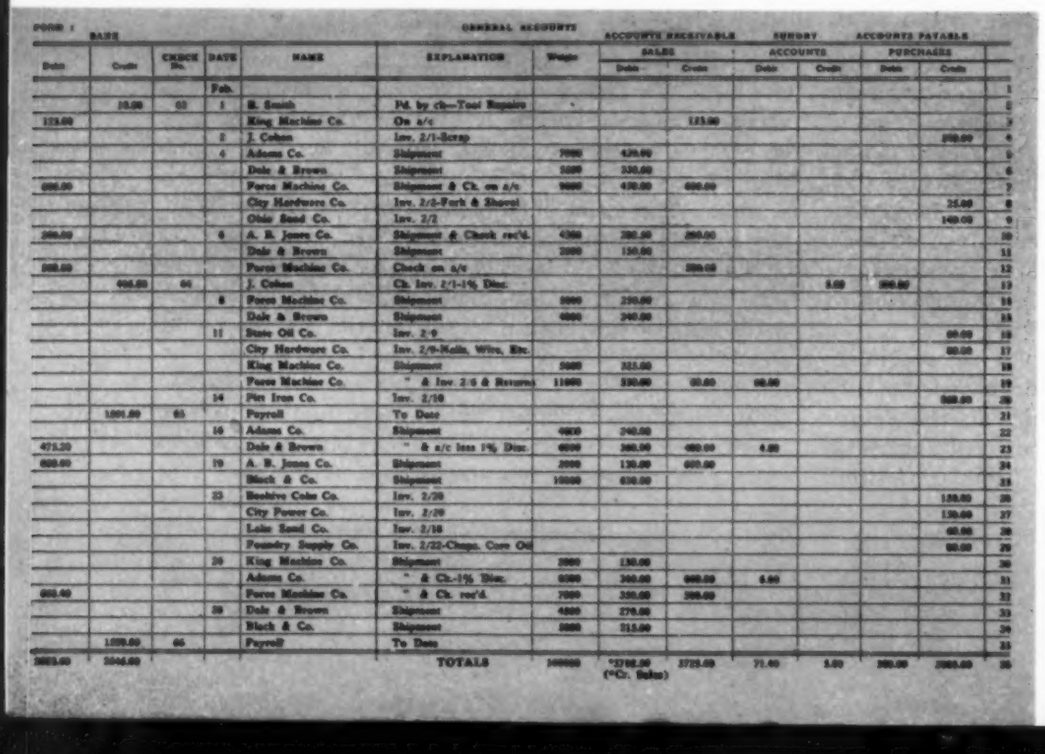
(2) Every entry of any kind should show *date* in proper column.

(3) In Accounts Receivable (Sales) columns are entered amount of each invoice covering shipment to customers under "debit." Under "credit" payments on account (re-paragraph 1) *or* for invoices *from* customer *or* for invoices *from* customer covering returns, etc. Total *weight* of shipment covered by each invoice entered in Column provided.

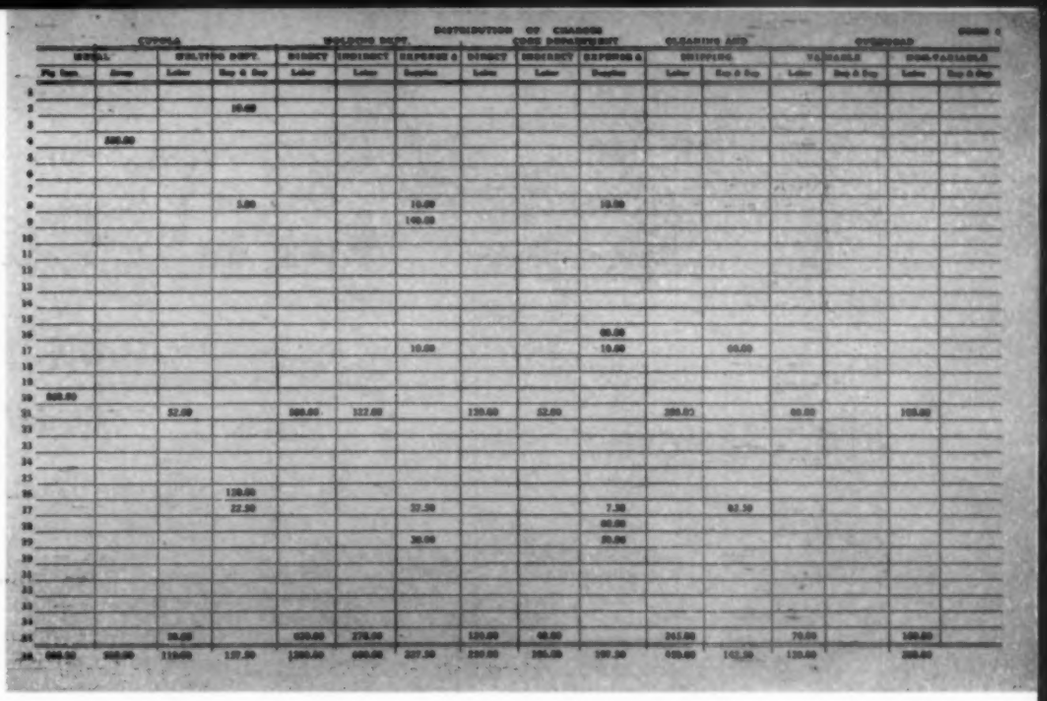
(4) In Accounts Payable (Purchases) columns are entered amounts of invoices covering supplies, expenses, etc. under "credit" after receipt of these items and under "debit" when these invoices are paid.

(5) Sundry Column is to be used for items not specifically covered otherwise, such as Capital Accounts, Special journal entries, charges which occur infrequently during the month, purchases of machinery, tools, equipment, etc.; Discounts (both allowed and taken); charges to sales occasioned by return of castings as referred to in paragraph (3) "Invoices from Customers." *All individual items in this column are posted direct to their respective accounts in the ledger as determined from the explanation column sixth from the left.*

(6) Distribution of the important items of operation is carried out in Form 2 and care should be taken to enter these



BASE Debit	BASE Credit	CHECK No.	DATE	NAME	EXPLANATION	Weight	ACCOUNTS RECEIVABLE SALES Debit	ACCOUNTS RECEIVABLE SALES Credit	SUNDRY ACCOUNTS Debit	SUNDRY ACCOUNTS Credit	ACCOUNTS PAYABLE PURCHASES Debit	ACCOUNTS PAYABLE PURCHASES Credit	
			Feb.										1
	10.00	63	1	B. Smith	Pd. by ch—Tool Repairs								2
123.00				King Machine Co.	On a/c			123.00					3
			2	J. Cohen	Inv. 2/1-Scrap							210.00	4
			4	Adams Co.	Shipment	7000	420.00						5
				Dale & Brown	Shipment	5500	330.00						6
600.00				Paros Machine Co.	Shipment & Ch. on a/c	9600	480.00	600.00					7
				City Hardware Co.	Inv. 2/3-Fork & Shovel							25.00	8
				Ohio Sand Co.	Inv. 2/2							140.00	9
200.00			6	A. B. Jones Co.	Shipment & Check rec'd.	4200	280.00	280.00					10
				Dale & Brown	Shipment	2000	130.00						11
500.00				Paros Machine Co.	Check on a/c			500.00					12
	400.00	64		J. Cohen	Ch. Inv. 2/1-1% Disc.				5.00	400.00			13
			8	Paros Machine Co.	Shipment	5000	250.00						14
				Dale & Brown	Shipment	4000	240.00						15
			11	State Oil Co.	Inv. 2/9							60.00	16
				City Hardware Co.	Inv. 2/9-Nails, Wire, Etc.							80.00	17
				King Machine Co.	Shipment	5000	325.00						18
				Paros Machine Co.	" & Inv. 2/6 & Returns	11000	550.00	60.00	60.00				19
			14	Pitt Iron Co.	Inv. 2/10							560.00	20
	1000.00	65		Payroll	To Date								21
			16	Adams Co.	Shipment	4800	240.00						22
475.20				Dale & Brown	" & a/c less 1% Disc.	4000	300.00	480.00	4.80				23
600.00			19	A. B. Jones Co.	Shipment	2000	130.00	600.00					24
				Black & Co.	Shipment	10000	630.00						25
			23	Beehive Coke Co.	Inv. 2/20							150.00	26
				City Power Co.	Inv. 2/20							130.00	27
				Lake Sand Co.	Inv. 2/18							60.00	28
				Foundry Supply Co.	Inv. 2/22-Chgo. Core Oil							90.00	29
			28	King Machine Co.	Shipment	2000	130.00						30
				Adams Co.	" & Ch.-1% Disc.	6500	390.00	600.00	6.00				31
600.00				Paros Machine Co.	" & Ch. rec'd.	7000	350.00	300.00					32
			29	Dale & Brown	Shipment	4500	270.00						33
				Black & Co.	Shipment	5000	315.00						34
	1000.00	66		Payroll	To Date								35
3875.00	3046.00				TOTALS	300000	*3798.00 (*Cr. Sales)	3723.00	71.00	5.00	300.00	2000.00	36



Note: In Form 2 to the right, the various accounts are as follows: Metal (10) Melting Department Labor (12); Melting Department Expense and Supplies (13); Molding Department Direct Labor (21); Molding Department Indirect Labor (22); Molding Department Expense and Supplies (23); Core Department Direct Labor (31); Core Department Indirect Labor (32); Core Department Expense and Supplies (33); Cleaning and Shipping Labor (42); Cleaning and Shipping Expense and Supplies (43); Overhead Variable Labor (102); Overhead Variable Expense and Supplies (103); Overhead Nonvariable Labor (112), and Overhead Nonvariable Expense and Supplies (113)

charges correctly under the various headings. Under Pig Iron and Scrap, the invoices covering these respective materials are entered together with freight and delivery charges.

(7) Under Expense are entered those invoices, etc., covering charges of expense, materials, supplies, etc. which can be properly charged to the various departments as shown by one of the following methods of distribution:—Actual or Estimated Departmental consumption; Departmental Payroll; Departmental Floor Space or Departmental Equipment Value.

(8) Care should be taken to make proper Classification of labor charges when made on Form 3, Payroll Distribution Sheet,—at the time the regular payroll is made up when drawing check or checks,—should be distributed under their respective Classification of Form 2 of "Foundry Business Record." Daily time or job tickets or cards simplify the collection of this information and should be used where and when possible to do so.

(9) The total "debits" of Forms 1 and 2 as they face each other in the binder should exactly balance the "credits" of the same forms. The totals of the columns are carried forward to their respective columns on the next sheets ahead before starting new entries.

(10) At the end of the (*Please turn to page* 68)

FORM 3

PAYROLL FEB. 14th, 1936 — **DISTRIBUTION**

LABOR ACCOUNTS

Name	Clock No.	Hrs.	D.W. Rate	Earnings	Cupola Labor 12	Metal Direct Labor 21	Metal Indirect Labor 22	Core Direct Labor 31	Core Indirect Labor 32	Clean & Ship. 42	Variable Labor 102	Non-Variable 112
J. Bates	101	40	.60	24.00	24.00							
S. Cuto	102	40	.70	28.00	28.00							
S. Pearl	202	80	PW	64.00		64.00						
A. Brown	203	80	.75	60.00		60.00						
S. Cast	204	80	PW	60.00		60.00						
J. Kulek	205	80	PW	64.00		64.00						
B. Smith	206	80	PW	64.00		64.00						
W. Block	207	80	.60	48.00		48.00						
S. Jones	210	80	PW	48.00		48.00						
K. Zabo	211	80	PW	48.00		48.00						
P. White	214	80	PW	60.00		64.00						
J. Green	215	80	.80	64.00		64.00						
S. Pack	252	80	PW	40.00			40.00					
J. Roll	254	80	PW	40.00			40.00					
K. Tarr	256	80	.50	40.00			40.00					
D. King	257	85	.40	34.00			34.00					
R. Fry	258	85	PW	34.00			34.00					
C. Peters	259	80	PW	32.00			32.00					
J. Ray	260	80	.40	32.00			32.00					
M. Spiro	262	65	.40	26.00			26.00					
L. Long	264	80	.55	44.00			44.00					
W. Gray	303	80	.45	36.00				36.00				
P. Ford	305	80	.40	32.00				32.00				
A. Link	306	80	.40	32.00				32.00				
R. Lang	308	40	PW	20.00				20.00				
A. Alt	310	20	PW	10.00				10.00				
J. Wise	351	70	.40	28.00					28.00			
W. Mach	352	60	.40	24.00					24.00			
A. Myer	402	80	.40	32.00						32.00		
B. Ott	405	70	.40	28.00						28.00		
L. Perry	407	70	.40	28.00						28.00		
K. Bing	408	80	.04	32.00						32.00		
O. Long	409	70	.40	28.00						28.00		
W. Laub	411	70	.40	28.00						28.00		
G. Rule	412	50	.50	25.00						25.00		
J. Tarr	413	10	.40	4.00						4.00		
J. Porter												
Foreman		60	1.00	60.00							60.00	
O. Haup	510	80	.65	52.00								52.00
J. Migan	511	80	.60	48.00								48.00
				1501.00	52.00	580.00	322.00	130.00	52.00	206.00	60.00	100.00

FORM 3

PAYROLL FEB. 28th, 1936 — **DISTRIBUTION**

LABOR ACCOUNTS

Name	Clock No.	Hrs.	D.W. Rate	Earnings	Cupola Labor 12	Metal Direct Labor 21	Metal Indirect Labor 22	Core Direct Labor 31	Core Indirect Labor 32	Clean & Ship. 42	Variable Labor 102	Non-Variable 112
J. Bate	101	50	.60	30.00	30.00							
S. Cuto	102	40	.70	28.00	28.00							
S. Pearl	202	80	PW	64.00		64.00						
A. Brown	203	80	.75	60.00		60.00						
S. Cast	204	80	PW	60.00		60.00						
J. Kulek	205	80	PW	64.00		64.00						
B. Smith	206	80	PW	64.00		64.00						
W. Block	207	80	.60	48.00		48.00						
S. Jones	210	80	PW	48.00		48.00						
K. Zabo	211	80	PW	48.00		48.00						
P. White	214	80	PW	60.00		60.00						
J. Green	215	80	.80	64.00		64.00						
B. Redd	217	50	PW	40.00		40.00						
S. Pack	252	80	PW	40.00			40.00					
J. Roll	254	80	PW	40.00			40.00					
K. Tarr	256	80	PW	40.00			40.00					
D. King	257	80	.45	36.00			36.00					
R. Fry	258	80	.40	32.00			32.00					
C. Peters	259	80	PW	32.00			32.00					
J. Ray	260	80	PW	32.00			32.00					
M. Spiro	262	65	.40	26.00			26.00					
W. Gray	303	80	.45	36.00				36.00				
P. Ford	305	80	.40	32.00				32.00				
A. Link	306	80	.40	32.00				32.00				
R. Lang	308	40	.50	20.00				20.00				
J. Wise	351	50	.40	20.00					28.00			
M. Mach	352	50	.40	20.00					20.00			
A. Myer	402	80	.40	32.00						32.00		
B. Ott	405	70	PW	28.00						28.00		
L. Perry	407	70	PW	28.00						28.00		
K. Bing	408	80	PW	32.00						32.00		
O. Long	409	70	.40	28.00						28.00		
W. Laub	411	70	.40	28.00						28.00		
G. Rule	412	50	.50	25.00						25.00		
J. Tarr	413	60	.40	24.00						24.00		
J. Banks	415	50	.40	20.00						20.00		
J. Porter												
Foreman		70	1.00	70.00							70.00	
O. Haup	510	80	.65	52.00								52.00
J. Migan	511	80	.60	48.00								48.00
				1539.00	58.00	620.00	278.00	120.00	48.00	245.00	70.00	100.00

NOTE:—

Account 12 Cupola Men and Chargers—Melting Dept. Labor.
Account 21 Molding Dept. Direct Labor—Molders and Helpers.
Account 22 Molding Dept. Indirect Labor—all other labor.
Account 31 Core Dept. Direct Labor—Core Makers.
Account 32 Core Dept. Indirect Labor—all other labor.
Account 42 Cleaning and Shipping Labor.
Account 102 Variable (Overhead) Labor—Foreman each Dept.
Account 112 Non-Variable (Overhead Labor—General foreman and general labor.

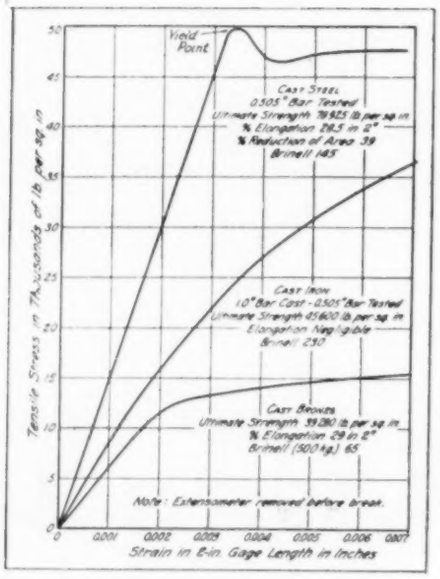

Yield Point
Cast Steel
0.505" Bar Tested
Ultimate Strength 78925 lb per sq in
% Elongation 28.5 in 2"
% Reduction of Area 39
Brinell 143
Cast Iron
1.0" Bar Cast - 0.505" Bar Tested
Ultimate Strength 25600 lb per sq in
Elongation Negligible
Brinell 230
Cast Bronze
Ultimate Strength 39280 lb per sq in
% Elongation 29 in 2"
Brinell (500 kg) 65
Note: Extensometer removed before break.
Tensile Stress in Thousands of lb per sq in
Strain in 8-in. Gage Length in Inches

Fig. 128 — Stress-strain diagrams of cast steel, cast iron and cast bronze

Gray Cast Iron

By JOHN W. BOLTON

Chapter XII

Strength and Elasticity

STRENGTH of a material is an excellent criterion of its utility in mechanical service. By strength we infer ability to resist mechanical forces which distort or which, if high enough, may fracture the material. Strength is measured by (a) rigidity and (b) resistance to breakage. Tests have been devised to measure the rsistance to various sorts of forces. Forces encountered in service, and even in testing usually are complex. For example, the apparently simple tensile test of a ductile material is accompanied by shear phenomena.

Mechanical tests applied to cast iron can be divided into two groups, (a) so called static tests, and (b) dynamic tests. In the static tests loading is slow. In the dynamic tests the load application is nearly instantaneous. The classification is qualitative. Common static tests include: Tension; creep; compression; shear, transverse and ring tests; torsion, and identation (Brinell, Rockwell). Usual dynamic tests include: Impact (single blow and repeated); fatigue (endurance), and damping.

Before considering the test methods and results, reconsideration of the structure of gray iron is desirable. Gray iron consists of a coherent metallic matrix, throughout which many nontenacious graphite flakes are dispersed. A simple if crude way to state this is that cast iron consists of a steel-like matrix with a number of spaces filled with a noncoherent material, graphite. The amount, size, shape and distribution of the graphite flakes have an important bearing on the strength of gray iron, in fact in many instances they are the major factors affecting strength. Presence of these flakes makes gray iron behave quite differently than steel under stress.

In an interesting set of experiments, Thum and Ude — *Zeitschrift des Vereins Deutscher Ingenieure,* page 251, 1930—cut holes and slits in steel samples and showed that the steels then behaved quite like cast irons in many respects. They varied the sizes of the holes and slits on different samples and showed that changing the sizes of the cuts altered the mechanical properties of the steel in much the same way as a change in graphite flake size does in gray iron.

Loading Must Be Axial

In the regular tensile test for gray iron it is important that the loading be axial, so that any cross bending effects are avoided. For precision work a practically frictionless universal joint device such as the Robertson shackle is preferred, although for routine work ordinary ball joint suspension is sufficient to give satisfactory results.

Every time a tensile load (stress) is placed on a piece of material, there is some stretch (strain). If we take an extensometer (a precision instrument for measuring changes in length), place it on a tensile test bar and gradually load the bar, the extensometer shows the amount of strain for each increment of load. If we plot stress (load) against strain (extension) we get stress strain curves like those shown in Fig. 128. If the relation of stress to strain is constant the curve is a straight line, and we may say the material is elastic and follows Hooke's Law. The place where the ratio

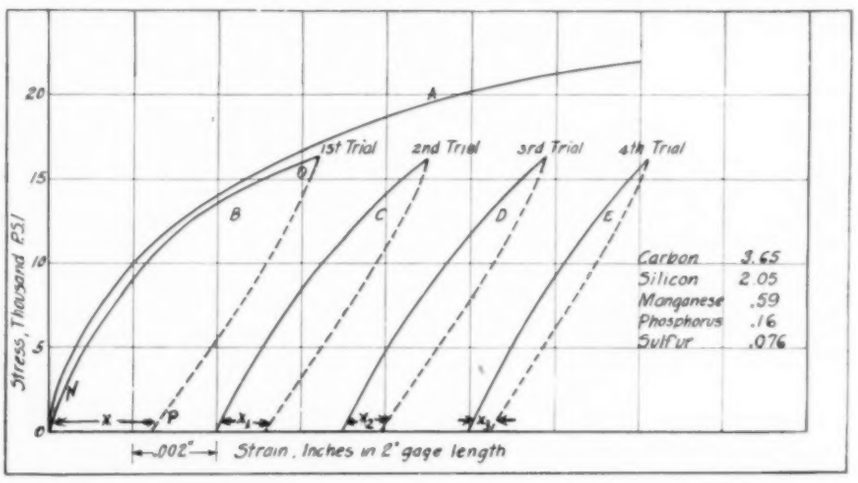


Fig. 129—After several restressings the stress-strain curve approaches a straight line and further permanent set does not occur

ceases to be constant and the straight line becomes curved is called the proportional limit or in less precise terminology the elastic limit. Measurements of extreme precision indicate that the term proportional limit is relative, as the more precise the measuring device the lower the proportional limit.

The complete stress strain curve shows three things, namely: (a) rigidity (proportional to the extension at a given load); (b) range wherein stress and strain are proportional, and (c) breaking load. The stress strain curve also indicates the work which must be done to distort and ultimately to fracture the specimen. That is indicated by the equation $W = FS$ where W is the work, F is the force, and S the distance.

The work is proportional to the energy required to overcome the resistance of the specimen and is measured by the product of the applied load and stretch or distortion for each increment and load and strain. The area under the diagram represents the work done.

On the chart shown in Fig. 128, steel is the most rigid of the three materials, cast iron next, and bronze last. If the curves at and beyond 0.003 inches strain are examined it is seen that the curves for the bronze and cast iron no longer approximate a straight line whereas that for the steel does. Considering the bronze, for example, at about 11,000 pounds per square inch, stress and strain are no longer proportional and with each increase in load the strain increments increase.

Elastic Limit Exceeded

This suggests that the material has been stretched permanently, or as the engineer says, its elastic limit has been exceeded. Since in this case we know that permanent distortion has resulted, the material is beyond its limit of useful elastic strength. Thus, although the ultimate or breaking strength of the bronze is over 39,000 pounds per square inch, only about one-fourth of that breaking strength is useful in resisting permanent deformation. On the other hand the cast steel can be loaded to about 45,000 pounds per square inch without permanent deformation, or to well over *half* its ultimate or breaking strength.

The curve for cast iron shown in Fig. 128 is curved almost from inception, hence apparently indicates no elastic limit. From the nature of the curve it might be concluded that cast iron, on long time loading, might

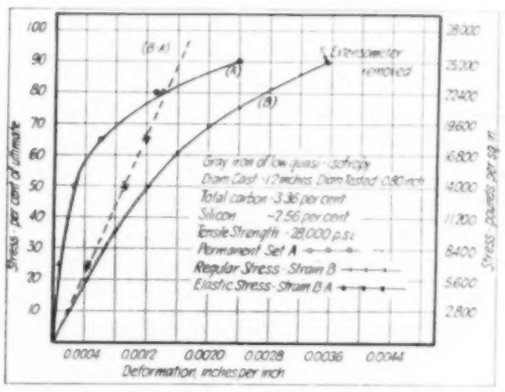

Stress per cent of Ultimate
Stress pounds per sq. in.
Deformation inches per inch
Extensometer removed
Gray iron of low quasi-isotropy
Total carbon -3.36 per cent
Silicon -2.56 per cent
Tensile Strength -28,000 p.s.i.
Permanent Set A
Regular Stress-Strain B
Elastic Stress-Strain B A

Fig. 130—Total plastic and elastic deformation in tension

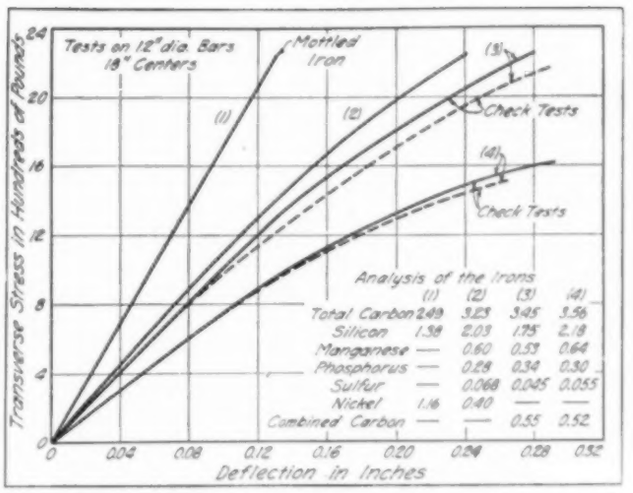


Fig. 131—Transverse stress-strain curve for mottled cast iron is shown with those of other cast irons

break at low stresses. Experience teaches that this is not so and the reasons follow:

When cast iron is stressed the resultant strain consists of both *elastic* and *plastic* deformation. The true tensile properties of gray iron are not shown fully in the ordinary tensile test. The breaking load or ultimate strength is determined, and the relative rigidity. To determine the possible elastic rigidity and the plastic deformation, repeated loading tests must be employed.

If a piece of gray iron is loaded, and the load is removed it will be found that plastic deformation or permanent set has occurred. On repeating the loading the curvature is decreased and on removal of the load a smaller permanent set is noted. After several restressings the stress-strain curve approaches a straight line and further permanent set does not occur. This is shown in Fig. 129. After 6 or 8 restressings the permanent set increments (X) approach zero.

Conclusions Drawn from Studies

Studies on the mechanism of plastic deformation or permanent set of gray irons lead to the following conclusions by Bolton—*Proceedings*, American Society for Testing Materials, Vol. 32, Part II, pages 477-487, 1932:

(1) Permanent deformation or set necessitates inelastic deformation of the continuous matrix, irrespective of the effects on the noncontinuous component (graphite flakes).

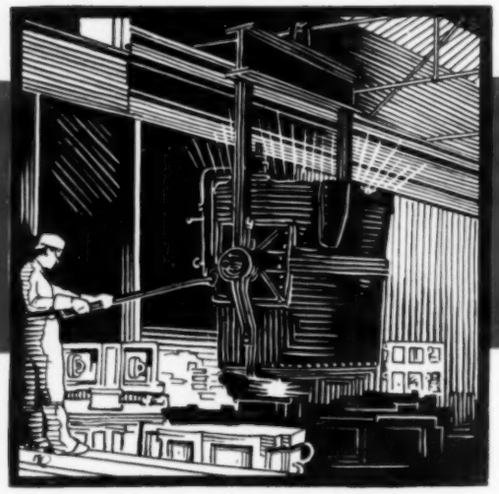
(2) The set phenomena are due to overstressing of the portions of the matrix lying along paths of greatest stress intensity.

(3) These paths of greatest stress intensity usually lie between those graphite flakes which most closely approach each other.

(4) It is possible that overstressing various paths at a given loading results in readjustment of the matrix and the stiffening of such paths, accounting in part for the diminution and disappearance of further set on repeated restressing at a given loading.

(5) When the stress is increased the increase in set is due to (a) further deformation of paths already overstressed at lower loads, and (b) deformation along new paths whose limit of elastic deformation has been exceeded.

(*Please turn to page* 79)



Questions and Answers

This department includes problems relating to metallurgical, melting and molding practice encountered in making castings. Questions from subscribers addressed to the Editor of The Foundry will be answered by members of the editorial staff, supplemented where occasion requires by the advisory staff.

Lost Wax Process Needs Considerable Skill

In our attempt to make castings by the lost wax process we find that our sand is not fine enough to impart the proper detail. It is not porous enough to vent freely, and the mold crumbles or cracks when heated to remove the wax. Can you refer us to any issue of THE FOUNDRY or other publications dealing with this subject?

Making castings by the lost wax or *cire perdue* process is a highly specialized branch of the foundry industry. We doubt if any person who has not had actual experience is competent to present full details. A fairly complete answer to a question similar to yours appeared in the Oct. 1, 1929 issue of THE FOUNDRY. From three to five page illustrated articles dealing with the foundry practice involved in the construction of statuary by the lost wax method and also by the alternative piece mold sand method appeared in the following issues of THE FOUNDRY: July 1, 1924, April 1, 1927; June 1, 1927; Oct. 15, 1928; Nov. 1, 1928; Feb. 1, 1930. Plaster of paris is the medium usually employed for the molds. A thin coating of plaster is applied to the pattern and the remainder of the mold body is made up of a mixture of plaster and silica sand thick enough to be applied like mortar.

Makes Green Sand Cores For Sanitary Pipe

We are having trouble with pipe castings for sanitary cast iron pipe. We believe it is in the cores. These cores are made of dry sand. The pipe is about 5-feet long and 4-inches in diameter. Can you tell us how green sand cores are made for the pipe?

Cores for sanitary, or as they more commonly are known, soil pipe, are made from green sand placed on a cast iron arbor; the top side of which is perforated with a series of small vent holes. The ends of the arbor are machined carefully to provide a smooth bearing surface. The arbor or core barrel is placed in trunnions so that it can be turned easily and the trunnion, with the core barrel in place, is located beneath a sand hopper whose bottom is V-shaped. The bottom of the hopper has a narrow opening, and the length of the hopper is such that it will extend over the full length of the core arbor.

The opening of the hopper is about 18-inches above the arbor, and the sand is allowed to drop on the arbor. Previous to supplying the sand, the core barrel is given a coat of clay wash, and then the sand is permitted to drop upon it. No additional means is used to make the sand, which is the same as that used for making the mold, adhere to the arbor. A strickle along the length of the barrel shaves off the excess sand and the proper diameter is reached. A sand thickness of ⅜ to ½-inch is the usual practice.

Arsenic In Copper May Result In Trouble

We would like to know if arsenic up to 1 per cent in copper would have any effect on steam bronze (85-5-5-5) subject to pressures of 200 pounds per square inch.

If 85-5-5-5 was made from copper with 1 per cent arsenic, it would mean that approximately 0.85 per cent arsenic would be present in the alloy. Of course, this does not allow for any vaporization of the arsenic lost in process of manufacture; but it does indicate that an appreciable percentage of arsenic would be present in the alloy and probably even in the final casting. In this alloy there is 5 per cent lead. Lead and arsenic combine readily to make a fluid alloy; but it may mean that the lead will settle to the lower part of the casting and the upper part of the casting will be short of its proper lead content. In other words, segregation takes place due to the fact that the lead-arsenic alloy is fluid some time after the rest of the

casting sets, and it is so thin and watery that it can ooze through a small orifice.

There have been some claims made for benefits resulting from the use of copper containing arsenic in the production of some of the alloys commonly used in the brass foundry. However, we have no record of authentic cases where such benefit has been uniformly secured, and it is debatable whether the arsenic was responsible for the benefit claimed. It is well known that an appreciable percentage of arsenic present in some of the red brasses tends to cause imbrittlement and this would be an objection in a casting that has to stand pressure test.

It would seem theoretically that 85-5-5-5 subjected to a 200 pound hydrostatic pressure would give more trouble from leakage with arsenic present than without it. However, this might not be the case if the casting walls are so thin that the metal sets almost immediately upon casting, and there is practically no metal removed in the process of machining. We all know that a casting may be perfectly tight until the skin is removed in the process of machining and if the skin is removed from both sides of the given wall, the porous metal only is left. It is our opinion that copper containing such a marked percentage of arsenic would not be desirable for the production of alloys which are later to be subjected to hydrostatic pressure, even if the pressure is no more than 200 pounds.

Hard Iron Balls Do Not Last in Service

Cast iron balls which we have made for cement grinding do not give satisfactory service. They crack and break instead of wearing away gradually. We melt a mixture of 80 per cent steel scrap and 20 per cent hematite pig iron in the cupola. The pig iron shows a silicon content of 3.50 per cent and manganese 1.50 per cent. Sulphur in the coke is about 0.38 per cent. The metal is poured into cast iron molds. We shall appreciate your advice on how to produce satisfactory castings.

Without a more detailed knowledge of the many factors involved it is rather difficult to diagnose the exact cause of your trouble. Off hand we should say that the iron mixture you are using should produce satisfactory castings. In the event that only part of the product is unsatisfactory the fault may be traced to the method of melting and tapping the metal from the cupola. The metal should be melted extremely hot. This result is secured by using coke with a high fixed carbon content, approximately 90 per cent. The charges are considerably smaller than the usual charges for any given size cupola. Thus where a 2000-pound charge of pig iron scrap iron may be melted satisfactorily in a 42-inch cupola, the charge of 80 per cent steel and 20 per cent pig iron should not exceed 1000 pounds. In addition to increasing the temperature of the metal, the small charges will result in a more homogenous mixture of the metal.

In the absence of a forehearth, a reservoir ladle under the spot should be provided to secure a more uniform mixture of the metal before it is taken away in smaller ladles for distribution among the molds. If you have access to back numbers of THE FOUNDRY you will find informative articles on the manufacture of hard iron balls from all steel scrap charges in the issues for April 15, and Oct. 1, 1926. The first is based on the electric melting process, while the second covers in detail the gradual evolution of a method for making satisfactory castings from all steel charges melted in the cupola. It is possible that with your present mixture a small addition of chromium may be all that is necessary, say from 0.6 to 0.8 per cent. However, through use of much higher percentages of chromium the balls will be harder and more wear resistant.

Beauty and detail of nickel silver candlesticks made possible by plaster Paris molds. Illustration courtesy International Nickel Co.

Cylinder Casting Leaks On Test

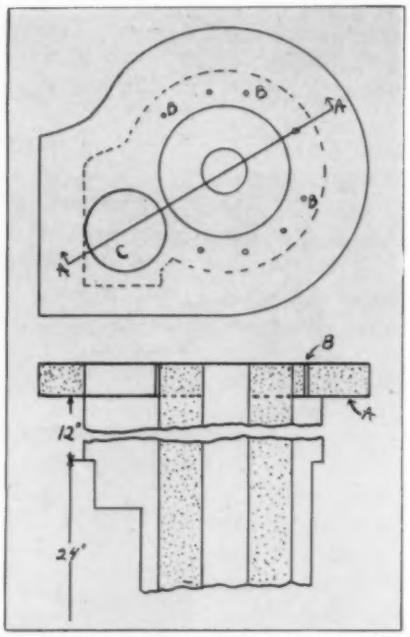
The heavy section of a cylinder casting leaks when subjected to oil pressure of 1500 pounds per square inch. The mold for the casting 6 inches diameter outside, 4 inches diameter inside and 24 inches in length, is made in a core and poured on end. A long sprue extends almost to the bottom and the metal enters through three gates spaced about 6 inches apart in a vertical line. Analysis of the metal follows: Silicon 1.50 per cent, sulphur 0.089 per cent, phosphorus 0.16 per cent, manganese 0.77 per cent, total carbon 3.11 per cent, chromium 0.40 per cent, nickel 1.58 per cent.

Under the microscope the metal shows a more open grain than one might anticipate from the given analysis. The method of molding and gating would produce a satisfactory casting for any ordinary purpose. However, in this instance where the casting is subjected to such high pressure, methods out of the ordinary must be applied to secure a dense, homogenous structure throughout. Although no direct evidence remains in the samples submitted for examination we are inclined to the opinion that the metal did not lie quietly against the center core.

A certain amount of gas was released and diffused through the casting. The outside and inside core also prevented the casting from cooling as quickly as it would in a green sand mold and as a result the granular structure is coarser. In this connection also it is pertinent to point out that you can increase the hardness of the mixture without impairing the machinability, when the metal is cast in a dry sand or core mold. This can be done either by lowering the silicon or raising the chromium content. Cooling of the casting also may be accelerated, and the amount of internal gas cut down by using a core with an opening approximately 1¾ inches through the center.

In addition this hole may be filled with water immediately after the casting is poured. Increased density of the casting may be secured by enlarging the pattern 1 inch all around at the top and extending it 12 inches as shown in the accompanying illustration. The top is covered by a flat ring core *A* which fits snugly around the center core and holds it in place. The cover core is pierced by eight ¼-inch gates *B* and by a 4-inch riser *C*.

After the mold is set up a pouring basin (not shown) is made up on top of the core. This method of gating introduces the metal under ideal conditions and promotes solidification in the casting from the bottom to the top. The last metal to enter the mold is the hottest and therefore in the best condition to compensate for the natural shrinkage. The additional 4-inch feeder merely is an



Cylinder casting is poured on top through eight ¼-inch gates

extra safety factor. It probably is not necessary, and may be discarded on subsequent castings. However, on the first trial it is advisable to use it and pump the metal with a rod.

Ram Sand Too Hard In Elbow Mold

We are forwarding a piece of iron cut from the drag side of a 6-inch case iron elbow in which numerous cavities appear after the threads are cut on the inside. The molds are made in iron flasks on a drop head machine. Binder in the dry sand core is held to a minimum. Facing sand contains 6 parts new sand, 6 parts old sand and 1 part sea coal. According to A.F.A. standards the heap sand shows a fineness number 113, clay classification E, sand classification No. 3 E, and moisture content of 7 per cent. We shall greatly appreciate your opinion on the cause of, and the remedy for this form of defect.

Direct cause of the honeycomb area in the section of casting submitted for examination is steam, but the origin of the steam in this particular instance may be traced to one, or more probably a combination of causes. According to the figures presented, the sand is satisfactory, with the exception that the moisture content is a little high. That in itself might not cause any truble, but if, as we suspect, other hazardous features are present, this extra moisture is a contributing factor.

Basing a belief on the evidence submitted we are inclined to the opinion that the sand is rammed too hard immediately in contact with the highest part of the drag pattern. The flask may be too shallow, or the bottom board may fit so tightly that steam in the lower part of the mold cannot escape. Either or both of these features will cause the metal to *boil* in the mold. The bubbles rise and come into contact with the cold core and remain there.

The remedy is to (a) reduce the moisture content of the sand to 6 per cent, (b) adjust the ramming device to reduce the density over the high points on the pattern and (c) provide a passage for the steam to escape from under the casting. This can be done by using a perforated board or plate, or, by forming vent channels in the sand immediately under the bottom board.

Iron Affects the Melting Loss

We have heard varied opinions expressed on the amount of iron lost in the cupola melting process. Some men claim that the loss should not be over 1.00 per cent, while others state that the loss may be as high as 10.00 per cent. This refers to the furnace loss represented by the difference in weight between the total cupola charge and the total weight of iron recovered from the floor, castings, gates, sprues and scrap. Has there been any reliable data published on this particular item?

In *Principles of Iron Founding*, the late Dr. Moldenke presents the results of experiment and observation on the amount of iron actually lost in the cupola melting process. He found that the amount varied depending on the character of the iron in the charges. On machine cast pig iron containing about 2.00 per cent silicon, the loss was 0.30 per cent. The loss on sand cast pig was 1.00 per cent. Melting loss on stove plate and other light scrap may be as high as 8 per cent, while the highest loss of all is experienced with burned grate bars and other scrap of a like character where the loss may reach 14 per cent. The following list is presented to show the average melting loss of the several kinds of foundry metal going into ordinary mixtures: Machine cast pig, 0.30 per cent; sand cast pig, 1.00 per cent; car wheels, 2.00 per cent; first quality machinery scrap, 2.50 per cent; light machinery scrap, 3.50 per cent; stoveplate scrap, 8.00 per cent. Poor melting practice will add another set of losses. Thus the carbon is going down and the iron itself will waste away through oxidation, going into the slag.

Blower Needed for Small Cupola

We have a small cupola 16 inches diameter inside the lining with two tuyeres 4 inches diameter opposite each other and 10 inches above the sand bottom. The blast is supplied by a forge blower. Is this blower large enough? How much coke should I place on the bed? What is the proper weight for iron and coke charges?

If your forge blower is designed to supply air for several fires, it probably is large enough to supply air for a 16-inch diameter cupola. A 16-inch cupola has a melting capacity of approximately one ton per hour and that means you will need a blower capable of delivering at least 24,000 cubic feet of air per hour, or 400 cubic feet per minute.

The coke bed should extend about 36 inches above the tuyeres after it has burned through and settled down. You will have to determine the proper weight of iron in the charges by experiment. Start with 150 pounds and if conditions seem to warrant the change, gradually increase the amount up to 200 pounds. The same advice applies to the coke. Start with a ratio of about 1 to 8, say 20 pounds of coke to each 150 pounds of iron. An interesting article on the construction and operation of a 12-inch diameter cupola appeared in the August, 1933 issue of THE FOUNDRY.

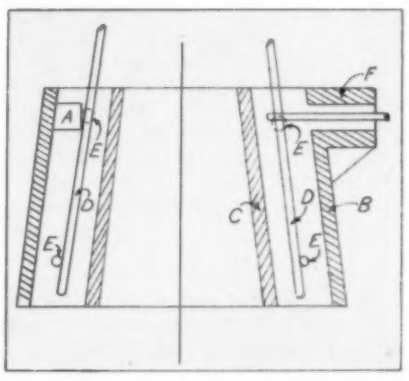
Cores Blow in a Water Jacket

We are having trouble with the core blowing in a jacket casting 11 inches diameter, 8 inches deep, weight 33 pounds for a laundry water heater. The core is entirely surrounded with metal with the exception of two small openings for pipe connections at the side. At present we gate this casting at the top and provide two small risers. We shall appreciate your advice on how to gate the casting and vent the core.

The gating system is immaterial. If you are making the casting in a square flask the sprue may be placed in one corner and connected to the top edge of the casting by two shallow branch gates. If the casting is made in a round flask the sprue may be placed in the center with two shallow branch gates 3 or 4 inches apart on top of the green sand core. From the fact that you gate this casting at the top we assume that the pipe connections are near the top. If they were, say, half way down, the casting would be parted in the center, half in the cope and half in the drag.

Since we are not familiar with your present type of corebox we cannot state positively the best and most convenient method of venting the core. A satisfactory method for one type of corebox might not be applicable in whole or in part with another. For example the corebox may be in one piece with a bottom and two loose pieces over the top at one side to form the pipe connection. The box may be open top and bottom with two prints near the top in which the separate connection cores are pasted later. The box may be designed to draw vertically or laterally. Again, it may be only a half-box and the two half-cores later are pasted together to make a complete core.

Any of these variations will introduce a variation in the method of venting. Irrespective of the type of corebox, the core should be made from all sharp sand bonded with a minimum amount of oil and should not be rammed hard. Also the core should be dried almost to the point of burning. By observing these three precautions you will reduce the volume of gas generated during the pouring process to a minimum. Since the core is surrounded entirely by metal with the exception of two small openings, it is apparent that the vent passages must be larger and more numerous than in a core with a greater exposure to the atmosphere. Suggested method of venting the core is shown in the accompanying illustration. At the left the box is shown with a print *A* which remains in the sand until after the corebox is removed from the core. This print then is removed laterally, and leaves a hole for the reception of the short pipe connection core later. At the right the loose piece *B*, a narrow strip the width of the branch core, remains in place until after the box has been removed.



Core is vented with upright rods and horizontal strands of wax

In each case the box is rolled over twice. The core is rammed in the position shown. The box is inverted and the inner ring *C* is removed and replaced by a thin dryer shell. The box then is rolled back to the original position and lifted away from the core. In the first case print *A* is then removed. In the second case the loose piece *B* is taken away. In ramming the core about an inch of sand is packed in the bottom, then the vent rods *D*—six or eight—are placed in position. A wax vent *E* is laid in the sand touching the vent rods. Sand then is rammed as high as the prints where another wax vent ring is placed as shown. The sand then is rammed to the top and the vent rods are drawn out. The openings are plugged with the fingers. The only reinforcing rods needed in the core are two pieces of wire in the branch core at the left. In the event that the core has a straight wall, the loose piece at the right is not needed. A loose piece *F* is removed first and the space filled with black sand. A plate is placed on the core which then is inverted and the box may be drawn in the opposite direction.

Has Difficulty In Removing Chills

We find difficulty in removing chills from round holes in our iron castings. These chills vary from 1 to 8 inches in length and from 1 to 6 inches diameter. We have painted the chills with fire clay, rosin, soapstone and plumbago but have abandoned them all as impractical for one reason or another. Do you know of any coating material that will prevent the metal in the casting from adhering to the chill.

Irrespective of what material is employed to coat the chill, considerable force will be required to remove the chill from the casting. This is due of course to the fact that the metal in the casting contracts and grips the chill firmly. If it is practical or feasible to remove the chill immediately after the casting solidifies, the force required will not be as great as that required after the casting has contracted to the full extent. This feature is taken advantage of in permanent molds where inside members are extracted before the casting commences to contract. Under ordinary conditions the only apparent alternative is to push the chills out of the castings under a hydraulic or geared power press. Some castings will withstand this treatment, while others will crack. A chill coating that is used extensively is manufactured by one of the foundry supply firms. This will prevent the metal from adhering.

We believe that if you make your chills from an alloy cast iron containing about 14 per cent nickel, 7 per cent copper and 2 per cent chromium much of your trouble will be eliminated.

Franklin R. Hoadley

J. R. Patterson

Arthur J. Tuscany

L. N. Shannon

MEN OF INDUSTRY

FRANKLIN R. HOADLEY has resigned as vice president of the Farrel-Birmingham Co., Ansonia, Conn., to become president of the Atwood Machine Co., Stonington, Conn. He will continue his present duties at Ansonia until Jan. 1.

Mr. Hoadley was born in Ansonia in 1890 and received his early education at Hill school, Pottstown, Pa. After his graduation from Yale university in 1914, he became connected with the Farrel Foundry & Machine Co., Ansonia, as an apprentice. Following war service, Mr. Hoadley was re-employed by the Farrel company as foundry manager in 1919. He was elected a director in 1923 and following the merger with the Birmingham Iron Foundry Co., Derby, Conn., in 1927, became a director of the newly-formed Farrel-Birmingham Foundry & Machine Co. Inc.

Mr. Hoadley was made vice president in 1930. He is vice president of the National Founders association, past president of the Gray Iron Founders' society, member of the Durable Goods Industries committee which devoted much time in Washington during 1934 to a study of causes contributing to unemployment in heavy industries and a member of the American Foundrymen's association. His father, the late FRANK E. HOADLEY, for many years secretary of the company, terminated 50 years of service with the Farrel Foundry & Machine Co., in 1920.

♦ ♦ ♦

L. DOUGLAS SMITH, president, Lewis Foundry & Machine Co., Pittsburgh, and president of the Groveton Land Co., both subsidiaries of the Blaw-Knox Co., Blawnox, Pa., has resigned to become general sales manager of McKeesport Tin Plate Co., McKeesport, Pa., a newly created post. Mr. Smith formerly had been vice president of the Lewis company and also of the Union Steel Castings Co., another Blaw-Knox subsidiary.

♦ ♦ ♦

LESTER N. SHANNON, chairman of the Birmingham District Chapter of the American Foundrymen's association, is vice president of the Stockham Pipe Fittings Co., Birmingham, Ala. Born in Carbon Hill, Ala., in 1893, he received his early education in the public schools, later attending Birmingham Southern college from which he was graduated in 1912 with a bachelor of science degree. Since his graduation, Mr. Shannon has been affiliated with the Stockham company. Long active in association affairs, he is a member of the American Society for Testing Materials, the American Society of Mechanical Engineers and is a director of the American Foundrymen's association.

♦ ♦ ♦

WILLIAM C. SNYDER JR. has been elected vice president and manager of roll sales of the Lewis Foundry & Machine Co., Pittsburgh. Shortly after his college career, he became affiliated with the Wheeling Mold & Foundry Co., Wheeling, W. Va., and in 1927 he joined the Lewis company as metallurgist and rollmaker. FRANK O. LEITZELL has been elected vice president in charge of machinery sales of the company. He became connected with the Blaw-Knox Co., Blawnox, Pa., of which the Lewis company is a subsidiary, as an engineer-salesman in the sheet and mill specialties department, in 1919.

♦ ♦ ♦

ARTHUR J. TUSCANY, associated with Tuscany, Turner & Associates, Cleveland, was elected to a 3-year term as director of the American Trade Association Executives, the national professional organization of executives engaged in the direction of trade associations, at the seventeenth annual meeting of the organization held in Cleveland, Oct. 15 to 17.

♦ ♦ ♦

J. R. PATTERSON, formerly general manager of sales, has been made vice president in charge of sales for the Mackintosh Hemphill Co., Pittsburgh. F. C. T. DANIELS, identified with the company for a number of years in engineering capacities, has been named vice president in charge of research and development. C. HOWARD PAUL, assistant treasurer, has been named assistant to the president of the Mackintosh company. He will retain his former position.

♦ ♦ ♦

ALBERT H. THOMAS, first vice president of the Buckeye Steel Castings Co., Columbus, O., has been elected president, to succeed the late J. C. WHITRIDGE. Mr. Thomas has been associated with the company more than 31 years and was elected first vice president 9 years ago. GEORGE T. JOHNSON, formerly second vice president of the company, has been elected first vice president, succeed-

(*Concluded on page* 40)

DAYTON oil in your core room means perfect cores *every day* in the year.

We have the laboratory and mechanical equipment necessary to produce quality materials—every drum of each grade is *always* the same.

ASK THE MEN WHO USE IT

We also manufacture the following materials — all scientifically compounded to give high heat resistance.

DOCO CORE WASH
OLD MASTER CORE WASH
DOCO BINDER & CORE PASTE
DOCO STEEL CORE & MOLD WASH

(*Concluded from page 38*)

ing Mr. Thomas, and FRANK H. BONNET, who has been connected with the firm more than 20 years and at present is superintendent of the foundry division, has been named second vice president.

♦ ♦ ♦

M. W. NORTH, formerly connected with the Simplex Products Co., has been made office manager of the Pyrometer Service & Supply Corp., Cleveland.

♦ ♦ ♦

WILLIAM C. BAIRD, president of the Buffalo Pipe & Foundry Co., Buffalo, has been appointed a member of the executive board of the Buffalo chamber of commerce.

♦ ♦ ♦

GEORGE TORRENCE, formerly president of Link-Belt Co., Chicago, has been made vice president and general manager of the Rayon Machinery Corp., Cleveland, a subsidiary of the Industrial Rayon Corp.

♦ ♦ ♦

E. J. BOGNAR has become affiliated with the Union Mining Co., Pittsburgh, as vice president in charge of refractories and research. He was formerly connected with the Corundite Refractories, serving 3½ years as co-receiver and manager for that company.

♦ ♦ ♦

R. W. ROBBERSON, J. B. Klein Iron & Foundry Co., Oklahoma City, Okla., recently was elected a member of the joint traffic conference committee at the recent convention of the American Institute of Steel Construction at White Sulphur Springs, W. Va.

♦ ♦ ♦

JAMES P. WILLIAMS has become affiliated with the American Steel & Wire Co., Cleveland, in the capacity of industrial engineer. From March, 1935 to October, 1936, Mr. Williams was respectively electric furnace operator and time study engineer for the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

♦ ♦ ♦

SAMUEL EPSTEIN, until recently research metallurgist, Battelle Memorial institute, Columbus, O., has become affiliated with the research and development department of Bethlehem Steel Co., Bethlehem, Pa. He had been active with the national bureau of standards and the research staff of the Illinois Steel Co., Chicago.

♦ ♦ ♦

FREDERICK S. COOK has been appointed Pacific coast manager of the Robert W. Hunt Co., Chicago, and will have his headquarters at San Francisco. He is a graduate of Columbia university with a degree of engineer of mines. Mr. Cook engaged in the operation and examination of lead and zinc properties, with headquarters at Joplin, Mo., from 1905 until the opening of the war. Following his service and since 1919 he has been vice president and secretary of the McCraken-Ripley Co., Portland, Oreg.

♦ ♦ ♦

DR. C. H. WATSON, New York, medical director of the American Telephone & Telegraph Co., recently was re-elected president of the National Safety council, at the Twenty-fifth National Safety congress in Atlantic City, N. J.

♦ ♦ ♦

FRANK N. SATTER recently was appointed district manager of sales for the Cleveland and Youngstown, O., districts for the Lawrenceville Bronze Co., Pittsburgh. His headquarters will be at 3030 Euclid avenue, Cleveland.

♦ ♦ ♦

CLARENCE W. HOWATT, formerly vice president of the Pittsburgh Steel Foundry Corp., Glassport, Pa., recently became associated with the Erie Foundry Co., Erie, Pa., as Pittsburgh sales representative with offices in the Grant building, Pittsburgh.

♦ ♦ ♦

STEPHEN L. FEDUSKA, a graduate of the University of Pittsburgh and formerly associated with the Continental Roll & Steel Foundry Co. as assistant to the director of metallurgy, has been appointed metallurgist of the United Engineering & Foundry Co., Pittsburgh.

♦ ♦ ♦

THEODORE H. PICKERING has been appointed manager of the Batavia, N. Y., plants of the Doehler Die Casting Co., Toledo, O., succeeding the late CHARLES I. HODGSON. Mr. Pickering has been in the company's employ for the past 8 years in sales and executive duties.

♦ ♦ ♦

H. W. HARMAN, for many years head of the research and engineering departments of the Stearns Magnetic Mfg. Co., Milwaukee, has been transferred to the sales department in the capacity of sales engineer with supervision of the purchasing department.

♦ ♦ ♦

FRANK M. FARMER, vice president and chief engineer of the Electrical Testing Laboratories, New York, has been elected chairman of the Engineering Foundation, New York. D. ROBERT YARNALL, Yarnall-Waring Co., Philadelphia, has been re-elected vice chairman of the Foundation. OTIS E. HOVEY, New York, L. J. QUENEAU, metallurgist, United States Steel Corp., New York, and PROF. WALTER I. SLICHTER of Columbia university, have been elected to the executive committee.

♦ ♦ ♦

GEORGE H. BUCHER has been elected executive vice president of the Westinghouse Electric & Mfg. Co. and will have his headquarters at the home office in Pittsburgh. He is also president and general manager of the Westinghouse Electric International Co.

♦ ♦ ♦

W. C. STRAUB, formerly manager of the New York branch office, Chicago Pneumatic Tool Co., has been appointed assistant to the executive vice president of that organization. A. D. STEM has succeeded Mr. Straub as manager of the New York branch office.

♦ ♦ ♦

PAUL S. LANE, chief metallurgist of the Koppers Co., American hammered piston ring division, Baltimore, has assumed his new duties as metallurgical research engineer of the company. Mr. Lane is secretary-treasurer of the Baltimore Chapter of the American Society for Metals and a member of the American Foundrymen's association.

♦ ♦ ♦

E. F. FEELEY, representative of the International Nickel Co. in South America and J. S. VANICK, a member of the company's development and research division, are visiting several South American countries within the next few months to offer consultation service to industrial executives and engineers, on problems involved in the production and application of nickel alloys.

♦ ♦ ♦

PHILIP A. HILL now is associated with the Belle City Malleable Iron Co. and the Racine Steel Castings Co. at Racine, Wis. For the past 14 years he has been with the Superior Steel & Malleable Castings Co., Benton Harbor, Mich. Previous to that connection, Mr. Hill was connected with the National Malleable & Steel Castings Co., Chicago.

Company Expands

Harry W. Dietert Co., Detroit, is building a 60 x 90 foot modern plant at 9330 Roselawn avenue, Detroit, with additional land available for future expansion. Expenditures also are being made to improve manufacturing facilities and the research laboratory of the company. All expansion is to be completed by Dec. 1.

ADVERTISING PAGES REMOVED

Foundrymen Meet at Iowa City

Conference Features Sand Control, Melting Practice and the Use of Alloys in Iron

FOUNDRYMEN of the central west displayed exceptional interest in the foundry conference held Oct. 30 and 31 at the State University of Iowa, Iowa City, Iowa. Approximately 150 registered for the two-day session staged under the joint sponsorship of the State university, the American Foundrymen's association, the Quad-City Chapter of the American Foundrymen's association, and the Northern Iowa Foundrymen's association, for the promotion of better castings and better acquaintanceship in the district.

The Friday morning session was opened by A. V. O'Brien, department of mechanical engineering, State University of Iowa, and a member of the committee on arrangements. Prof. Byron J. Lambert of the school of engineering, extended the official welcome of the university. Robert E. Kennedy, technical secretary of the American Foundrymen's association, responded and thanked the university and the other sponsoring bodies for the co-operation in arranging the conference.

Features Sand Control

Harry W. Dietert, Harry W. Dietert Co., Detroit, presented the first paper on "Molding Sand Control" with P. T. Bancroft, Moline, Ill., acting as chairman. Mr. Dietert discussed a number of factors, which, when given proper attention, provide the means of making better castings for the same cost. The speaker discussed numerous steps which should be taken to reduce scrap since, in his opinion, scrap castings loss is greater than most foundrymen assume. He described methods of handling and controlling molding sands, and presented a casting defects chart which permits the foundryman to determine quickly the various factors affecting certain types of castings. At the close of the program, Mr. Dietert demonstrated the equipment used in the sand control laboratory.

Horace Deane, Deere & Co., Moline, Ill., outlined the sand control work carried on at his plant. The company started in a small way by making sand control tests on new sand with some of the equipment recommended for the purpose. The program has been enlarged and the company has developed standards governing certain properties in the new sand. Permeability and strength tests of floor sand and a check on the moisture content are made once a day. Mr. Deane stated that he has found that the use of an aerator once a week or oftener shows definite benefits in the molding sand.

Results of a series of tests to determine the possibility of using fuel oil in place of sea coal in the facing sand, were presented by R. E. Wilke, John Deere Tractor Co., Waterloo, Iowa. The speaker stated the tests indicate that the only favorable result from the use of oil is that it prevents molds from drying out where it is necessary for them to stand for some time. When the oil is used in amounts comparable to sea coal, an excessive amount of gas is created and the sand becomes sticky and gummy. It was stated in the discussion that one company using fuel oil finds it more satisfactory in connection with light castings than with heavier sections, that dust is reduced, and that little trouble is encountered in tempering the sand.

The first portion of the Friday afternoon meeting featured the paper "The Fundamentals of Testing Cast Metals," by Prof. H. L. Daasch, Iowa State college, Ames, Iowa, with Prof. R. M. Barnes, State University of Iowa, presiding. Prof. Daasch discussed in some detail the types of chemical, physical and metallographic tests employed in connection with cast metals. Under chemical tests, the speaker stressed the importance of proper sampling, and the need for considering variations in castings' shape, dimensions, casting conditions, etc. in making tests.

In the discussion of physical tests, Prof. Daasch defined certain terms used, such as stress and strain and the strength property terms such as proportional limit, elastic limits, commercial elastic limit, yield point, ultimate strength, and breaking strength. The speaker then discussed various types of strength tests and hardness tests. Under metallographic testing, he included information on macroscopic, microscopic and x-ray examination. Following the paper, the meeting adjourned to the Materials laboratory of the university, where Prof. Chesley J. Posey and members of the staff demonstrated various tests made on cast metals.

A session on cupola practice, with P. T. Bancroft presiding, followed the testing demonstration. In the first talk, Fred J. Walls, International Nickel Co., New York, stated that present day trends in cupola operation are featured by better melting efficiency, higher melting temperatures, more uniformity, and faster melting. Higher temperatures are made possible by higher beds, a high volume of air, and co-operation of the refractory, coke and pig iron manufacturers in providing the type of materials best suited for the purpose. Mr. Walls recommended the use of a high bed, from 50 to 75 inches, and at the same time an increase in blast volume, since in his opinion the iron is superheated after the melting operation and while passing through the bed. He stated that a long soaking time should not be used, but that blast should be put on as soon as the charge is in the cupola. While several who discussed the subject agreed with Mr. Walls, one cupola operator stated that he uses a soaking time of 1 hour and has found that it makes little difference in the temperature of the first metal tapped.

Slag Important Product

Mr. Walls stressed the fact that slag is one of the most important products of the cupola. In a discussion which followed, it was stated by one operator present that he found dolomite stone gave a better slag than straight limestone. The dolomite contained from 38 to 40 per cent magnesium. Another stated that at times old broken cores are charged in the cupola when the scrap used is especially clean. Another stopped milling the gates and sprues because it was found that the silica sand carried on this return scrap had a beneficial effect in producing a good slag.

E. K. Smith, Electro Metallurgical Co., Detroit, discussed the use of alloys in connection with metal melted in the cupola. Mr. Smith

(*Concluded on page* 46)

OSBORN MOULDING MACHINES

• Vision and vitality are characteristics of the men who helped develop the Foundry Industry to its present high operating standards. Among these sturdy pioneers is Dan J. Ryan who, in 1897, made the first cylinder block casting produced in this country. In 1912, Mr. Ryan and associates organized The Allyne-Ryan Foundry Company, producers of RYANITE... a close-grained, chrome-nickel iron of high tensile strength, toughness, machinability and great durability. The company is a large producer of castings for cars, trucks, tractors and diesel engines. *Dan J. Ryan*... 57 years a foundryman... knows that TIME PROVES VALUES... in men, in metal and machines. The Allyne-Ryan Foundry Company... since its first heat on January 2, 1913 ... have always been large users of Osborn Moulding Machines.

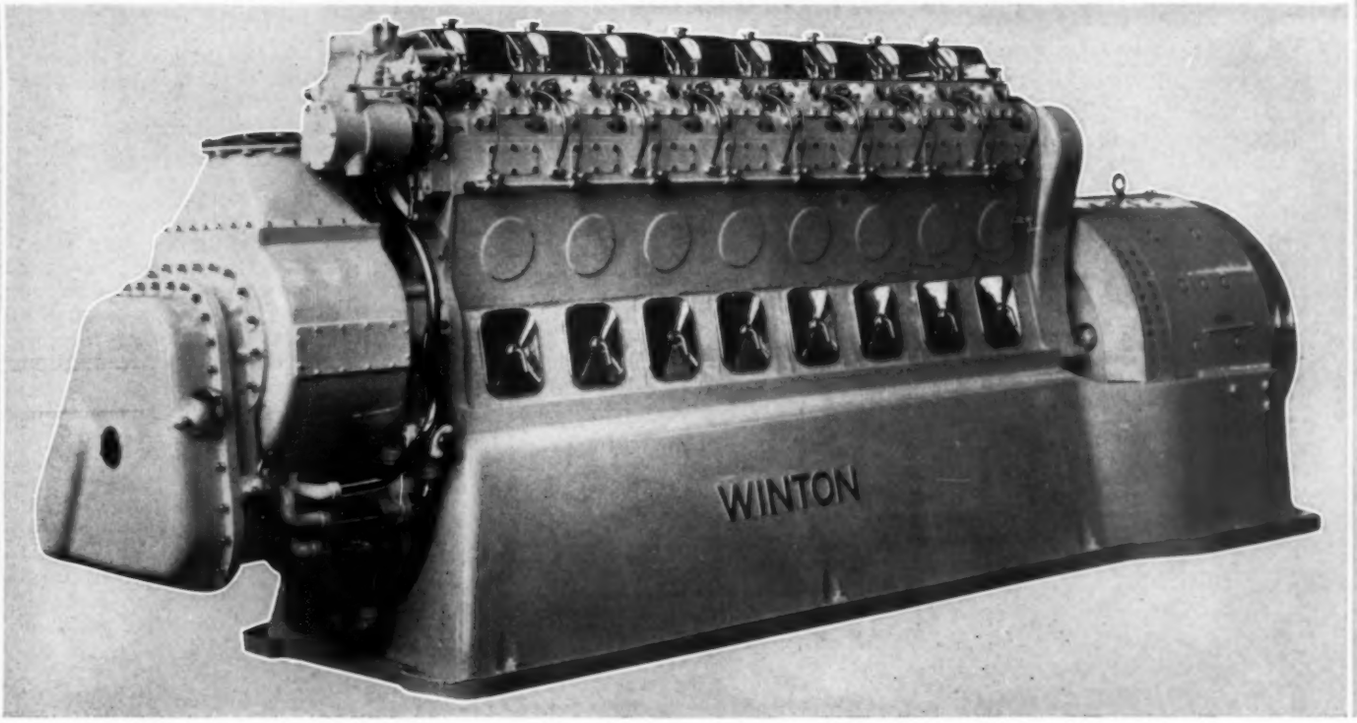
Speed

DAN J. RYAN
... 57 years a foundryman
President and General Manager
THE ALLYNE-RYAN FOUNDRY CO.
Cleveland, Ohio

TIME PROVES VALUES

OSBORN

Demands the Best



Unprecedented development of power units in the past quarter-century has been met by related developments in the Foundry Industry. An example is the 600 H. P., high-compression, eight cylinder Winton-Diesel engine which speeds the Burlington "Zephyr" trains over the rails . . . safely and economically.

The Allyne-Ryan Foundry Company . . . using Osborn Moulding Machines . . . produced the following parts made of RYANITE for the Winton-Diesel engine: Cylinder heads . . . cylinder sleeve liners . . . exhaust elbows . . . air intake and exhaust manifolds . . . oil pump body . . . valve stem guides . . . cam shaft bearings and miscellaneous parts. The combined developments of many industries make possible such outstanding achievements as the Burlington Zephyr trains. Developments in Osborn Moulding Machines keep pace with developments in other industries.

THE OSBORN MANUFACTURING COMPANY

3401 HAMILTON AVENUE CLEVELAND, OHIO, U. S. A.

Agencies strategically located all over the world

(*Concluded from page* 43)

stated that alloys may be added through the use of alloy scrap iron, alloy pig iron, ferroalloys and briquets. He stressed the value of the chill test as a control in alloy work, and stated that in his opinion alloy heats should be run at the end of the day to obtain the greatest recovery of alloys. Good foundry practice dictates that gates and sprues from alloy castings should be kept separate, and used in the cupola in making up alloy charges.

V. A. Crosby, Climax Molybdenum Co., Detroit, pointed to the increasing use of equipment for preheating the cupola blast. He discussed the advantages of using preheated blast and described the various types of equipment used for the purpose. D. J. Reese, Whiting Corp., Harvey, Ill., described a unit which employs separate firing with powdered coal, gas or oil.

Hold Dinner Meeting

A dinner at the Iowa Memorial Union building on Friday evening, was presided over by Prof. H. O. Croft of the State University of Iowa. Addresses were made by Dr. Edward Bartow, head of the department of chemical engineering, State University of Iowa and, Dean Francis M. Dawson of the Engineering college, State University of Iowa and short talks were made by T. J. Frank, Frank Foundries Corp., Davenport, Iowa, and chairman of the Quad-City Chapter of the A.F.A.; A. E. Hageboeck, Frank Foundries Inc., Moline, Ill.; A. V. O'Brien, State University of Iowa; P. T. Bancroft, Moline, Ill.; Robert E. Kennedy, American Foundrymen's association, Chicago, and Frank G. Steinebach, THE FOUNDRY, Cleveland.

The first session on Saturday morning was devoted to a symposium on alloy cast iron with talks by R. G. McElwee, Vanadium Corp. of America, Detroit; E. K. Smith, Electro Metallurgical Co., Detroit; V. A. Crosby, Climax Molybdenum Co., Detroit. F. J. Walls, International Nickel Co., New York, presided and spoke briefly on the use of nickel. Mr. McElwee stated it was quite necessary to know the composition of the base iron to which the addition is to be made. From an engineering standpoint, he believes that other properties than relative tensile strength are more important with reference to cast iron. Slides were used to show the influence of vanadium alone and in combination with other alloys on certain physical properties of cast iron.

Mr. Smith spoke of the use of chromium alloys for heat resistance. He stated that chromium forms stable carbides, reduces growth, produces a harder iron, and provides resistance to wear. The speaker emphasized the need for proper consideration of the base alloy, the use of the correct amount and right grade of the alloy material. Mr. Crosby stated that Molybdenum is employed as an alloy in castings where high strength is required and may be added to practically any base iron successfully. However, he pointed out it is desirable to start with the best iron for the particular purpose, since that practice reduces the amount of alloy which is needed.

A simultaneous session on nonferrous foundry practice was presided over by John Diedrich, Blackhawk Foundry & Machine Co., Davenport, Iowa. Harry W. Dietert assisted in the discussion which centered around the preparing and testing of sand for nonferrous work.

The last meeting of the conference was devoted to "Electric Furnace and Rotary Furnace Melting of Cast Iron," with A. E. Hageboeck presiding. W. R. Jennings, John Deere Tractor Co., Waterloo, Iowa, outlined the various advantages in melting high test gray iron in the electric furnace. The speaker also presented data comparing the cost of metal produced in the electric furnace and the cupola. He pointed out that a furnace operated at or above capacity produces metal at the spout at a lower cost than one operated at less than capacity.

R. E. McElwee, discussing electric furnaces, stated that it is possible to secure more constant results as to analysis with the electric furnace. He believes this is due to the fact that the electric furnace melts slower and that the metal is held in a bath, thus permitting greater diffusion. In his opinion, the electric furnace offers possibilities of introducing alloys in the most effective manner.

D. J. Reese, Whiting Corp., Harvey, Ill., described the Brackelsberg furnace and discussed numerous operating features of that unit. He stated that the ultimate temperature of a rotary furnace is not the ability of the furnace to produce a temperature but the highest temperature which the refractories can withstand. There was considerable discussion on the presentation by Mr. Reese.

Introduces Flux

Alumaweld Co. of America, Chicago, has produced a new flux which is said to make high strength permanent repairs on joints of any metal. It is applied with an ordinary soldering iron or blow torch and is claimed to have a tensile strength of 12,000 pounds per square inch. The finished joint can be machined or worked and takes a polish over which chromium or any other plating can be applied.

Care Required For Dust Systems

By C. A. Snyder
American Foundry Equipment Co.

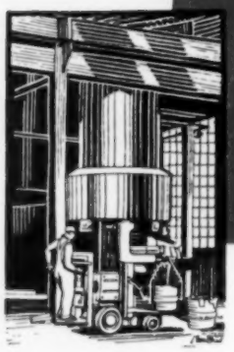
Dust control systems have been subject to an unusual amount of neglect after installation. Possibly most of this is due to the fact that the installation in itself is nonproductive, its chief function in most cases being the abatement of a nuisance. Many times responsibility of upkeep has been shouldered on an already overburdened millwright who, to keep actual production machinery in operation, has had to neglect the dust control installation. Usually, when the equipment is opened after such neglect, the entire inner structure appears engulfed with sand.

Responsibility for operation and maintenance of such a system should be placed in the hands of a competent mechanic. He should make either semimonthly or monthly observations and dated reports should be made in duplicate, one copy going to the plant manager, the other to the inspectors records. Neglect of a seemingly unimportant and in itself inexpensive repair may cause excessive damage to the installation and require a lengthy shutdown, not considering loss of equipment efficiency during that time.

A list of important details to be observed in making an inspection of dust control equipment includes the following: Hoods and piping for wear, structural damage, leaks, settlement of dust, etc., noting that slides fit tightly, checking blast gates for position and wear and inspecting pipe supporting members; pipe connections to collector housing for leaks, etc., including the collector housing itself; fan bearing for wear and lubrication, checking dust accumulation in fan housing and wear on fan wheel; tube plates for excess dust accumulation, lubrication of shaking device, baffle plates and condition of tubes from the inside; suction and volume readings with tube and manometer, comparing these readings with original test readings at time of installation.

A test of collecting efficiency should be made semiyearly by a competent individual using recognized technique in dust counting. By watching the permanent manometer which is connected across the dust collector, the proper time for shutting off the shaking device can be determined. Hoppers should be emptied daily. Keep a supply of spare parts on hand for replacement. An air velocity of 2200 feet per minute is required to convey metal dust grindings; 5000 feet per minute is required for lead dusts and 4000 for fine brass turnings.

FERRO
ALLOYS
Ohio Ferro-Alloys Corporation
Canton, Ohio



Viewing Foundry Developments

At Short Range

ADDITION of a small amount of hydrofluoric acid to a chromic acid bath will give a bright surface on aluminum which has a high reflective power according to a recent patent. The description indicates the addition of 1 per cent of the regular 48 per cent hydrofluoric acid solution, to a chromic acid solution containing 10 per cent by weight of chromic oxide. The bath is maintained at 49 to 58 degrees Cent. and the ware treated for 10 minutes at a current density of 46 to 52 amperes per square foot with a voltage from 16 to 22. The reflectivity of the aluminum after treatment was 87.2 per cent as compared to a silver mirror. Anodizing in 7 per cent sulphuric acid at 25 degrees Cent. for 10 minutes at a current density of 12 amperes per square foot with a voltage of 20 to 22 reduced the reflectivity slightly to 85.3 per cent.

♦ ♦ ♦

Iron of the following composition is said to give excellent results in the fluid end of slush pumps employed on drilling operations in the oil fields: Silicon, 1.10 per cent; manganese, 1.00 per cent; sulphur, 0.08 per cent; total carbon, 3.00 per cent; phosphorus, 0.12 per cent; molybdenum, 0.25 per cent; and nickel, 2.00 per cent.

♦ ♦ ♦

A new adhesive or cement has been developed which is said to be water and oil resistant, and which will mend or adhere to all common materials except rubber. It is flexible and transparent, and is a derivative of the alkyd resins.

♦ ♦ ♦

Melting practice for the 88 per cent copper, 9 per cent aluminum, 3 per cent iron alloy when using all new metals, is to melt down the copper under a good layer of charcoal, and then deoxidize with small successive amounts of carbon-free manganese until small buttons show a good shrinkage. Then about one-half of the aluminum is added, followed by the iron in the form of sand-blasted strips of sheet steel. After thorough stirring, the remainder of the aluminum is added. To the complete melt a flux of 0.5 per cent magnesium and manganese sulphate is added.

♦ ♦ ♦

Brass radiator valves which show a tendency to leak throughout usually are the result of too high a pouring temperature. Fracture of the casting also will show a general discoloration instead of localized spots as in the case of internal shrinkage.

♦ ♦ ♦

According to a recent patent a refractory cement which has excellent nonshrinking properties in addition to withstanding temperatures of 3500 degrees Fahr. or better, is composed of 72 parts of chrome ore previously heated to 3100 degrees Fahr. or higher; 21 parts of periclase; 5 parts of water-soluble sodium silicate, and 2 parts of water soluble starch. All materials are finely ground previous to mixing so that all pass through a 40-mesh sieve and 70 per cent through a 200-mesh sieve.

♦ ♦ ♦

CHEMICAL combination which converts the rust into part of the paint pigment is claimed for a new paint. Application imparts a hard, tough protective film which has good adhesion. The film is said to seal and stop further oxidation on old surfaces, and to prevent rusting action on new surfaces. Characteristics include weathering ability, resistance to acids, alkalies, and a number of corrosive agents. The paint is noninflammable, nonconducting, insoluble in water, gasoline, certain alcohols and oil.

♦ ♦ ♦

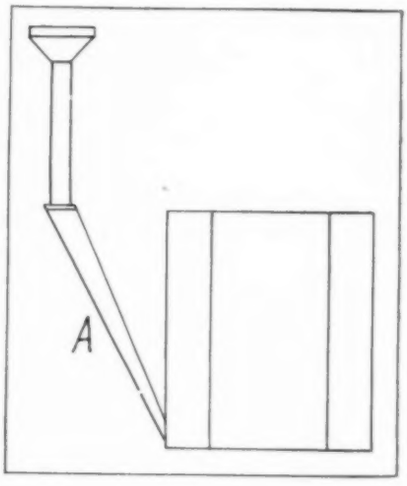
An aluminum alloy containing 14 per cent silicon, 2 per cent nickel, 0.9 per cent copper, and 1 per cent magnesium has approximately the same coefficient of expansion as corrosion-resisting, austenitic, nickel cast iron, and is designed for the manufacture of pistons for automotive use. In the heat treated condition the alloy has a yield point of 35,390 pounds per square inch, tensile strength of 39,200 pounds per square inch, elongation of 0.3 per cent, and a brinell hardness of 132. It is said to retain its strength and hardness well at elevated temperatures, having for example a brinell of 77 to 80 at 200 degrees Cent. (392 degrees Fahr.).

♦ ♦ ♦

A recently developed paint cleaning compound is claimed to be noninjurious to the workers' hands and the painted surface. It is supplied in dry form, and only requires mixing with water. Application is with a cloth or sponge wrung out so that it will not drip. Approximately 1000 square feet of surface can be cleaned at a material cost of 30 cents.

♦ ♦ ♦

AFTER trying various methods, a west coast bronze foundryman claims that he has had no trouble with bushing and bearing castings since he adopted the gating method shown in the accompanying illustration. Heavy castings 14 inches diameter, 24 inches in



height and 2 to 3 inches thick in the wall require no risers or feeders. The metal gate pattern *A* is rammed in the drag with the pattern. After the cope is lifted off the gate pattern is pulled out. The gate is tapered from 1-inch diameter at the joint to ¾-inch diameter at the point where it touches the pattern.

ADVERTISING PAGES REMOVED

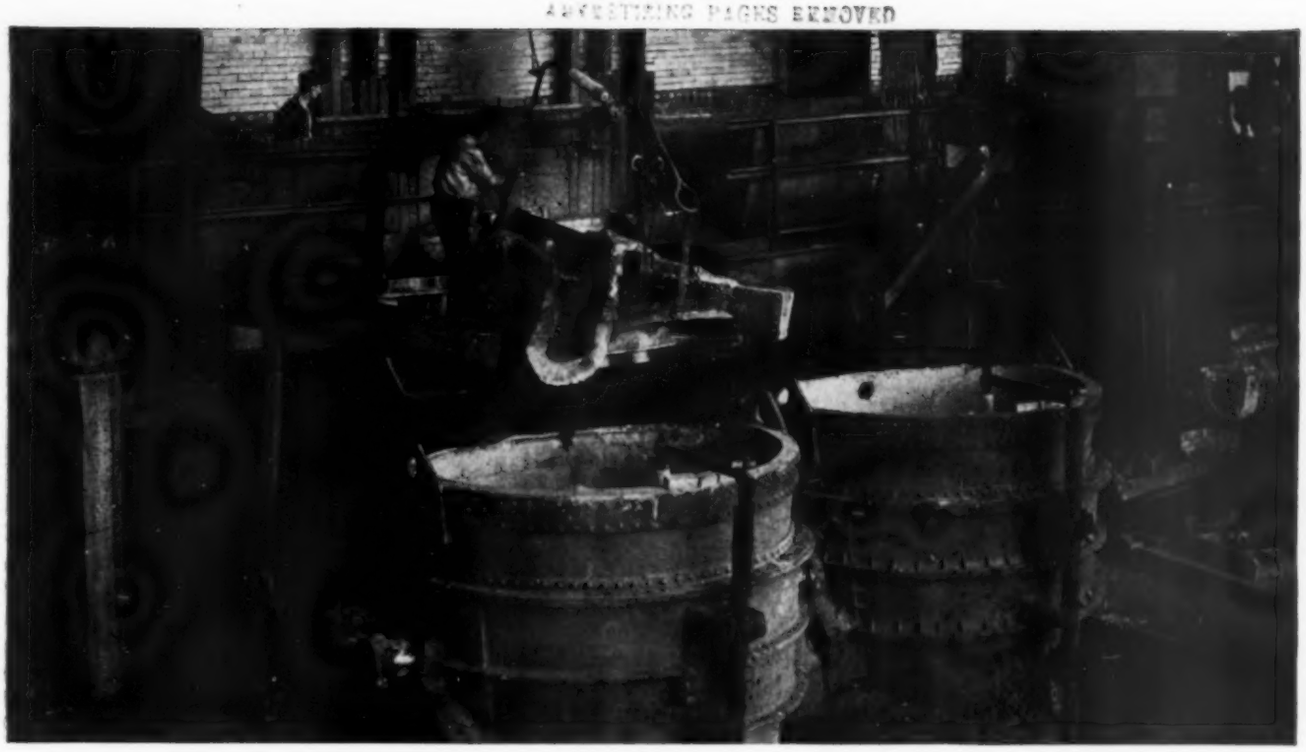


Fig. 1—Routine tapping of the open-hearth furnaces may be accomplished readily by use of the oxygen lance

Cut Metal with Oxygen Lance

IN THE iron and steel industry the oxygen lance has been used for many years for routine opening of tap holes in blast furnaces and open hearth furnaces, for cutting spills and skulls and for many other operations involving piercing or severing heavy masses of iron or steel according to a recent article in *Oxy-Acetylene Tips*.

The oxygen lance is a piece of pipe, usually iron, but sometimes copper, connected to a suitable source of oxygen in such a way that the gas may flow through the pipe at a regulated pressure. For convenience in operating, the lance pipe usually is attached to a handle, which in turn may be provided with a control valve.

Essentially the operating principle is identical with that of the familiar oxyacetylene blow pipe. A jet of oxygen reacts vigorously with a heated spot on iron or steel, generating a large amount of heat and forming a fluid slag of iron oxide and iron that readily flows away, thus constantly exposing fresh surface to the action of the oxygen jet. However, the oxygen lance differs from the cutting blow pipe in two important particulars.

The lance has no preheating flames. To start a cut it is necessary to preheat the starting point. With the iron lance pipe, the end may be heated and caused to burn by allowing oxygen to flow through the pipe. The combustion of the pipe itself may thus furnish the preheat necessary to start a cut. Once the cut is started the pipe gradually is consumed and supplies the heat necessary to keep the cut going. Usually in cutting heavy material it is advantageous to use the lance and blowpipe together. The lance supplies a jet of oxygen constantly right at the point where cutting is taking place, in contrast to the blowpipe where the gas jet always starts from the outside of the material being cut. Since the oxygen can be applied with equal facility at every point along the cut, right down to the bottom, the lance cuts equally well in all thicknesses, consequently its scope practically is unlimited. Masses of steel 8 feet thick have been severed and reduced to charging box size.

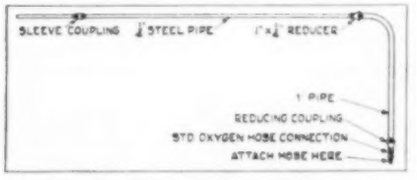


Fig. 2—Typical oxygen lance made from readily available material, a few pieces of pipe and threaded couplings

The pipe may be any size from ⅛ to ½-inch diameter, depending on the type and thickness of material to be cut. The lance pipe is made up of one or more sections each at least 5 feet in length. The section nearest the operator is threaded to fit a reducer or coupling which forms the end of the lance handle. Easy running threads on each end of each section facilitate quick connection. Each length should have the usual threaded sleeve. The assembly must be free of all oil or grease. These materials violently and spontaneously may ignite in combination with oxygen.

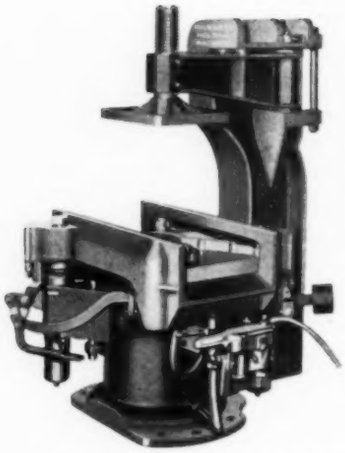
A typical setup is shown in Fig. 2. In practice there are many deviations in pipe size, length and style of handle. The simplest type of handle is a bent piece of 1-inch pipe with a reducing coupling on the lance end. This permits the operator to stand clear of the shower of sparks.

Heavy duty oxygen hose, not smaller than ⅜-inch diameter should be used for conveying the

(*Concluded on page* 54)

No. 103 Jolt Squeezer

Melt Borings



No. 142 Jolt Squeezing Stripper

No. 214
MILWAUKEE JOLT SQUEEZING STRIPPER

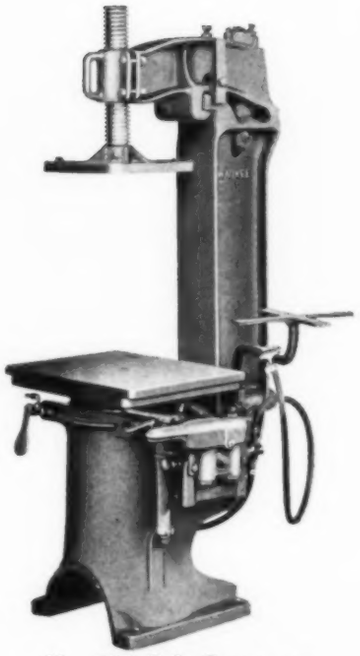
One operation eliminated by carrying mold away from machine with the squeeze head.

No. 70
CORE GRINDER

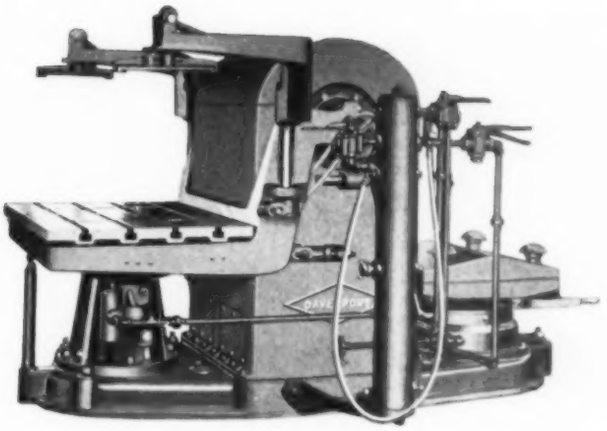
Precision built affording maximum grinding accuracy. Suitable for continuous operation or for large cores up to 72" in diameter.

MILWAUKEE FOUNDRY

3238 WEST PIERCE STREET **MILWAUKEE,**



No. 123 Jolt Squeezer
12" Squeezing Piston



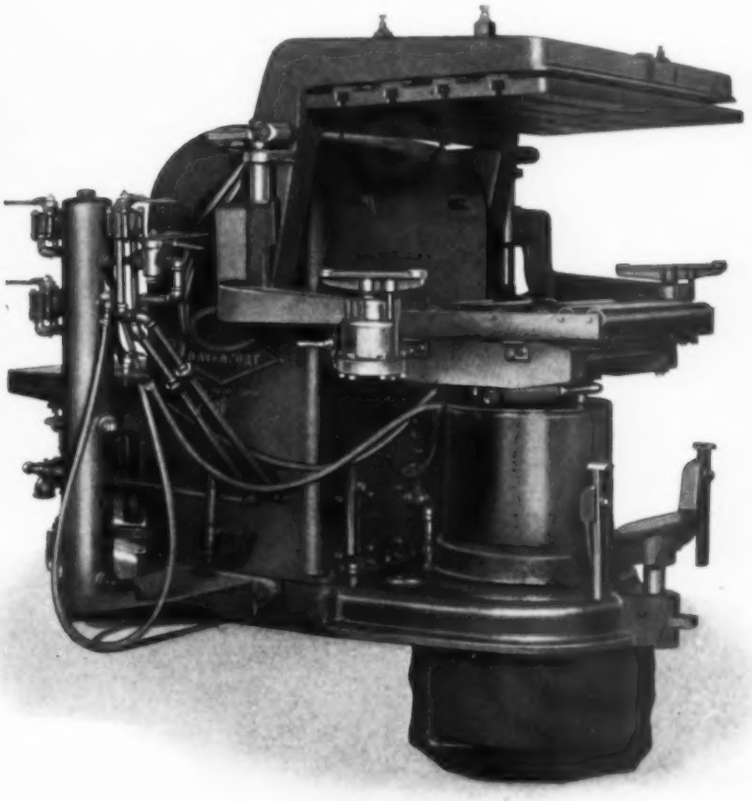
No. 28A Davenport
With Hand Clamps

No. 28A
DAVENPORT JOLT ROLLOVER DRAW
With Air Clamps and Roll-off Device

Entirely air operated, mold completely finished without operator leaving the control column.

350 TON MILWAUKEE BRIQUETTING PRESS

Conserve cast iron borings and get better metal control by briquetting.



EQUIPMENT COMPANY

WISCONSIN **CABLE ADDRESS "MILMOLDCO"**

(*Concluded from page* 51)

oxygen from the regulator to the lance handle. Pneumatic hose never should be used on account of the possibility of introducing oil or grease. Safety, economy, and convenience demand the use of a recommended type of oxygen regulator at some point between the oxygen cylinder and the lance, whether the oxygen is supplied from a piping system or from manifold cylinders. Consultation with a service representative of the oxygen or apparatus manufacturer regarding the particular work is advisable. No set rules can be laid down to cover the wide variations in conditions found in the field.

When used on ferrous materials the lance serves primarily as a tool for introducing oxygen into an already started iron oxidation reaction. For example, drilling a hole in a heavy metal slab. In this operation, a source of heat such as an oxyacetylene flame is used to bring a spot on the steel up to kindling temperature. The lance then replaces the blowpipe and feeds oxygen to the hot metal so that oxidation continues rapidly. While the lance pipe in this instance is consumed at the same time, thus serving to supplement the heat of the reaction while the cut is passing through a *dirty* section of the metal, the bulk of the heat required to keep the cut going is supplied by the oxidation of the material being cut.

When used on nonferrous or nonmetallic material, the combustion of the lance pipe supplies the entire amount of heat required to produce a fluid slag by reaction with the iron oxide. In drilling through slag, for example, the molten iron oxide produced by the combustion of the lance pipe acts as a flux to form a liquid slag which flows away, or which readily may be broken when cold. The lance action with such materials results from the combined effects of heat and chemical reaction.

New or old iron or steel scrap, spills, slag, skulls and hot tops are drilled or cut by the lance. Blast furnaces and open hearth furnaces generally are tapped by the lance. Demolition work of all kinds, including heavy cast iron or steel machinery becomes a simple matter. Holes are started in slabs to start shape cutting and other routine operation. On steel ladles the lance may be applied to loosen a stuck stopper or to open a partly closed nozzle. The hot steel obstruction provides the heat needed to start the reaction.

Book Review

A History of Science, by Sir William Dampier, cloth, 514 pages, published by the Macmillan Co., and supplied through THE FOUNDRY, Cleveland, for $2.50 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., London.

The history of astronomy, medicine, mathematics, biology, zoology, philosophy, theology, chemistry, geology, anatomy, physiology, physics, psychology and anthropology unfolds during the years 2500 B.C. to present times replete with the names of thinking men who have influenced the lives of modern men as well as their contemporaries. Many were the complexities and false turns. At times a man would lead off at a tangent for some years before another was able to free himself of inhibitions and fit the correct piece into the mosaic that the following bits of knowledge could be discovered and set into place.

An index of twenty-two pages, an introduction which is a concise summary of the history in the following pages and a table of 92 elements with symbols and atomic weight in the chapter on the new era in physics makes of this volume a handy reference book.

First Fall Illinois Meeting Is Held

Northern Illinois Foundrymen's association met Oct. 13 at the Hotel Freeport, Freeport, Ill., for its initial meeting of the fall season. H. S. Bennethum, president of the association, presided.

Rex Jennings, foundry superintendent, John Deere Tractor Co., Waterloo, Iowa, presenting the principal talk of the evening, discussed in analytical fashion "The Foundrymen of Today." He stated that better materials could be obtained if purchased according to analysis and specification.

The speaker pointed out that all types of foundries are represented in the United States, ranging from those dependent entirely upon skill to those dependent upon equipment. By comparisons and diagrams, he gave the causes of waste as total ignorance, faulty equipment and outright carelessness. It was emphasized that in the last few years rough measurements of castings had become the exception.

Relationship between management, foremen and workmen was discussed and Mr. Jennings concluded by urging a better understanding between engineering department, pattern shop and foundry.

Corrects Address

The new address of the Parsons Engineering Co. is 6511 Cedar avenue, Cleveland, instead of that mentioned in the October issue of THE FOUNDRY. Manufacturing facilities in the new location are much greater than those previously available.

ENGINEERING students devote considerable attention to the course in foundry practice at Kansas State College of Agriculture and Applied Science, Manhattan, Kans. Illustrations show the cupola and students pouring off. Edward Grant, instructor in foundry practice, is shown in the illustration at the right

SANDSLINGERS for STEEL FOUNDRIES!

You foundrymen operating steel foundries can now purchase *Sandslingers* from us without any restrictions or any agreement to sign. *Sandslingers* are now available for any type of steel molding work, jobbing, production, or cores.

They are more flexible than any other type of molding equipment, they ram all kinds of patterns where one or a thousand castings are to be made, and as has often been said — "there is no machine, or group of machines, that will produce as many molds, of as high quality, at as low cost, as the *Sandslinger!*"

Sandslingers increase production 50% to 100% or more in many shops on almost any class of work. They ram true-to-pattern, effect a definite saving in casting weight, reduce accessory equipment costs, and minimize floor space requirements.

Because of the sand density control possible only with *Sandslingers* and accuracy of ramming, they reduce casting losses to a minimum.

Sandslingers lower labor costs by increasing production, eliminating labor drudgery and fatigue, and insuring production control.

May we have a Beardsley & Piper foundry engineer give you complete details on *Sandslingers* and the Rental Purchase Plan which provides for their purchase on easy terms with payments spread over twenty months, and no interest or carrying charges? Write today for complete details.

Cut your costs with

BEARDSLEY & PIPER CO.

2541 N. KEELER AVENUE, CHICAGO, ILLINOIS

SANDSLINGERS SAND HANDLING PREPARING MOLDING AND SHAKE OUT EQUIPMENT

REPRESENTATIVES IN PRINCIPAL FOREIGN COUNTRIES

Well, a rose by any other name

The Adventures of BILL

By PAT DWYER

BILL suggested that instead of worrying over the thing and bothering every person I met by reciting the incident, I should write to old Seek and ask him for what Bill flippantly refers to as the whole ballyhoo.

The idea does not appeal to me. In the first place if old Seek still is the peppery individual I remember—and in all probability he has grown increasingly peppery with advancing years—he probably would write back advising me to keep my nose where it belongs, in the front of my face and pointing due north. Indeed I should not be surprised if he added a postscript to the effect that people with long and weasely noses give him a pain in the neck.

A good old stick and all that kind of thing, but no patience whatever with people, who under the guise of friendly interest come sniffing and prying and peeping into his personal affairs. If in the present instance he was responsible for shooting the dog, I am quite confident he was fully justified, but on the other hand if he was forced to cough up $100 for the pleasure—a point by no means brought out clearly in the published account—I am afraid he would not be at all his own sunny self. He might snap at me and I derive practically no pleasure from being snapped at. May be an allergic manifestation, or possibly lack of vitamin *C* or something.

In the second place I am not exactly worrying over the thing. I cheerfully confess to a little natural curiosity, but that is caused more by my inability to understand the story than by the right or wrong of the incident itself. So far as bothering every person I meet is concerned, that is a gross exaggeration. Outside of Bill I have not submitted the puzzle to more than a dozen or possibly 15 people altogether. How did it start? Well, if you insist!

Glancing casually through a newspaper from the old home town one night recently, my eye was arrested momentarily by the name of a man I have known since, well, since we were about that high. He has rather an odd name, a name that ordinarily would identify him at any time or place for the simple and aggravating reason that his parents in their innocent and amateurish ignorance weighed him down at the christening font with three—count 'em—three given names.

The initials of his three carefully concealed names are C. Q. F. Sticklers for accuracy might attempt to pronounce the three as one word. Those who tried it found the word rather difficult. The nearest approach is See-quoof, and who, may I ask in all seriousness would attempt such outlandish address, when the natural abbreviation Seek rolls so easily from the tongue. In early life to all seeking information he became Seek (Joke). Although I have not seen him for many years, I imagine he still answers to the good old moniker—name to you.

However, as I say, my eye fell on

Now if the dog had shot the man

the old familiar name with the three initials and that induced me to read an item I otherwise might have skipped as of no particular interest. The item was headed *Damage Case Is Concluded.* Well, well says I to myself, with a vision of women and diaries, pent houses and alimony, divorce, blackmail and other usual newspaper features, so the old boy has his tail caught in the fence. I wonder what kind of a tangle Seek is mixed up in now.

I read the item through in a rather hurried manner. Not that I did not have plenty of time but merely through habit. The general impression was so confusing that I felt compelled to read it over again. At the close of the second reading I still was left groping in the dark and fighting for air. Reluctantly I was forced to the conclusion that the mental apparatus either of the reporter or I needed a general overhauling. Something radically wrong either at the sending or receiving end. Naturally I hesitated to point even a mental finger of scorn at a presumably competent lad and of course if—as I more than half suspect—the reporter was a lady, I would be a very low fellow indeed to even hint that the story was not what is known in newspaper circles as a lulu. Mentally I labeled it with another word also commencing with the letter *l*, but with a—er—well, a slightly less complimentary meaning.

On the other hand and in strict justice to all concerned I did not relish the idea of setting myself up in the dunce's corner without a valiant struggle. I determined to lay the case before Bill.

"Keep your eye strictly on the ball," I warned him, "or perhaps it would be more appropriate to say watch the pea and the two little shells. Now you see it and now you don't. This is one case where the quickness of the reporter's hand de-

(*Continued on page* 59)

ADVERTISING MAGUS REMOVED

(*Continued from page* 56)

ceives the eye. Here in my hand I hold a newspaper clipping describing a case where a substantial citizen is hauled up before the beak for shooting another man's dog. All plain and aboveboard so far, but wait, that's all I have to say, wait until you hear the remainder of the story. If you can make sense out of it or determine which is the head and which is the tail, you're a better reader than I am Gum and Grin!"

Bill showed a marked lack of appreciation. "Probably kindergarten stuff," he remarked lazily. "Every dog has his day. However, since I have nothing on at the moment, le's have the good word, but cut it down to the bone."

"Kindergarten stuff, hey? That's what you think," I warned him darkly. " I have read the thing through several times and I don't know yet who is the plaintiff, who is the defendant, who owned the dog and finally which of the two had to pay the damages and costs. In fact the only clear statement is that giving the name of the man who actually shot the dog, and since he simply was an agent he does not figure in the final disposition of the case."

"Sounds like an interesting tale of a dog." Bill settled further back in his chair. "Go ahead. Shoot if you must this old gray head—no, no—I mean go ahead if you must and shoot the blinkin' dog. A figure of speech my dear boy for shoot the works. You have our ear, both of 'em in fact. And what, I ask you could be fairer than that?"

"Nothing. Listen."

I read the item through to the end, ignoring Bill's attempts at interruption. As I had expected and hoped, he immediately put on the war paint and feathers.

"Wait a minute," he said. "Something wrong with that thing. Read it over again slowly if you please. I am afraid the old ears are not what they were."

"A little shrinking or trimming would not do them any harm," I admitted tactfully. "In fact I often have wondered why your loving parents did not clip them while you were young and dumb, like a bull pup."

"I was not referring to the size," Bill said coldly. "Nice, generous size ears indicate sagacity. Ever notice an elephant? Wisest animal that roams the field or the jungle or wherever it is that elephants roam on their off days, his ears hanging down to his knees."

"Seems to me there is another animal with rather remarkable ears and yet he never is held up or quoted as an emblem of sagacity. You may have seen him in the early morning, leaning over the pasture bars, mouth open to expose all his air cooled teeth, the while he chants his matitudinal hymn to the rising sun: Hee-Haw, Hee-haw!"

"I get you," Bill admitted complacently. "You are thinking of the bird who wrote the story. Just flash it once again. I think I can make the grade this time."

"Okie-doke," I said. "Remember you asked for it:"

Damage Case Is Concluded

Fifty dollars and $50 in costs were awarded by His Honor Judge Mulcahy in the County Court yesterday in the action between Jeremiah Tennant and C. Q. F. Corcoran over the loss of a dog.

"That is only the opening paragraph with the plaintiff and defendant in their proper relative positions. In the next paragraph the reporter commences to shuffle the shells:"

The plaintiff and the defendant, it was stated, live on neighboring lots in the suburb of Shore Acres and in the statement of claim it was alleged that the plaintiff's dog, a cute little adorable Scotch terrier according to the owner and a miserable, yelping double dash nuisance by the other man, was shot by Robin Adair as agent for the defendant.

"All clear so far, you will note with the plaintiff one up and with Robin Adair caddying for the defendant. Now listen to the conclusion to the same paragraph."

In addition to $200 general damages, the *defendant* claimed $100 as the value of the dog, and $15 for breeding costs.

"Do you get that? So far apparently, the plaintiff—Tennant to you—was the aggrieved party seeking damages, recompense, satisfaction, revenge and what have you for the loss of his dog. Now, all of a sudden we are told 'In addition to $200 general damages, the defendant—the defendant, mind you—or in other words, jolly old Seek, the lad who shot the dog by deputy, claimed $100 as the value of the dog and $15 for breeding cost. See if you can wiggle out of that one."

"Continue. What did the judge say about this little pea-under-the-shell game?"

In rendering his decision His Honor declared: 'I think the amount claimed as damages by the plaintiff is excessive. He said: 'While the dog was a prize winner of note in shows,' the decision reads, the plaintiff is not in the dog business. Also furthermore and in addition, he is in a small community where the sale of dogs is infrequent.

"Good old beak," Bill interrupted. He seems to have his judicial feet solidly on the ground, and knows which litigant is plaintiff and which is defendant. Reading between the lines I should say offhand that his Honor does not own a dog. What else does he say?"

Continuing, Judge Mulcahy said: 'I cannot give vindictive damages as I think something might be said for persons who are annoyed by neighbors' pampered children and ideal pets of one kind or another.'

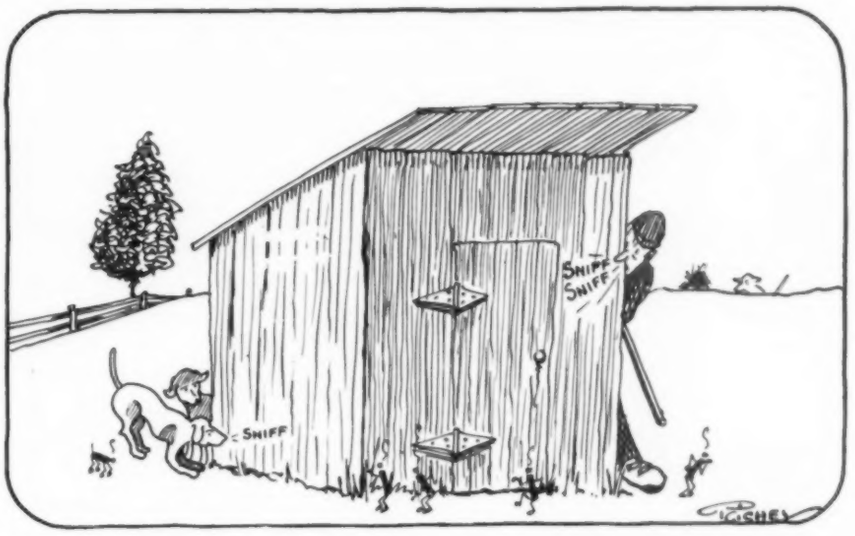
"I'll also venture the guess that the judge has no children."

"The reporter," I pointed out, "unfortunately does not throw any light on the judge's ownership of dogs or children. The point really is immaterial. However, in the concluding paragraph he has the learned jurist completely reverse himself. Here is the final paragraph in this comedy of errors:"

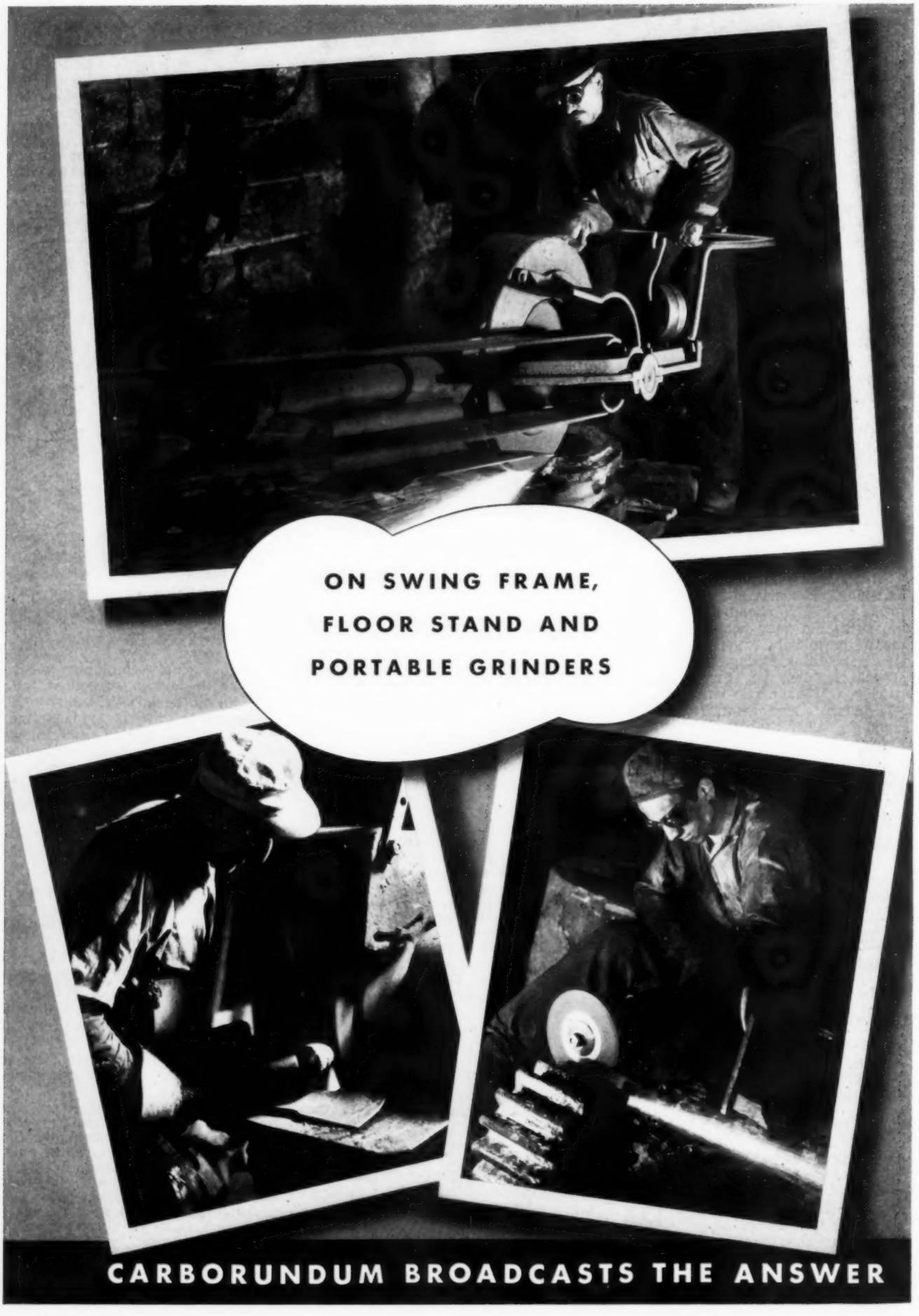
'In the opinion of the court,' the judge declared, 'the claim for cost of breeding is-ah-remote under the circumstances. I therefore,' he said, 'award damages in the sum of $50 to be paid by the *plaintiff*, together with costs which I fix at $50. The plaintiff shall also have his taxable disbursement to be agreed upon or taxed if necessary.'

"So what?"

"My congratulations to old Seek," said Bill. "The lucky dog!"



Sniff, sniff! Who's there? Endova! Endova who? Endova perfect day


ON SWING FRAME,
FLOOR STAND AND
PORTABLE GRINDERS
CARBORUNDUM BROADCASTS THE ANSWER

In the Foundries *of the* NATION

CUTTING down wheel and grinding costs — saving on motive and man power — the complete line of foundry grinding wheels by Carborundum are "snagging" their way to real grinding economy. And in hundreds of foundries, on thousands of jobs, on all types of metals, they are setting records for production.

For steels, malleables, certain types of semi-steels and hard irons the new Aloxite Brand Aluminum Oxide 180 Bond Wheels have increased cutting power, have a high rate of stock removal, maximum sharpness and require far less grinding pressure.

The improved Carborundum Brand Silicon Carbide Vitrified, Resinoid and Rubber Bonded Wheels for cast iron, brass, bronze, etc., complete the line which assures real efficiency in foundry grinding.

TUNE IN THE CARBORUNDUM BAND
Saturdays
at 7.30 P. M., E. S. T.
Columbia Chain

THE CARBORUNDUM COMPANY
REG. U. S. PAT. OFF.
NIAGARA FALLS, N. Y.

Sales Offices and Warehouses in New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Grand Rapids. (Carborundum and Aloxite are registered trade-marks of The Carborundum Company.)

TO EVERY FOUNDRY GRINDING QUESTION

Air Views on Slagging Spout

Depth of Molten Metal Behind the Dam Seems To Be the Controlling Factor

SOME of the peculiar features encountered in the operation of a front slagging spout, that is a spout in which both iron and slag flow through the tap hole of a cupola, are outlined by a foundryman who sought information on how to make up a slagging spout that will not blow at the tap hole. The cupola is lined to 78 inches, uses both upper and lower tuyeres, 16 ounces blast pressure and melts 85 tons per day. The spout has been made up as shown in Fig. 1 and tap holes have been tried 1¼, 1⅜ and 1½-inches in diameter, but in each case the cupola blew at the tap hole and cut away the tap hole brick. The dam in the spout has been raised to provide 2, 3 and 4 inches of metal above the tap hole, but without effect.

The following opinions were presented by four prominent foundrymen who have had extended experience with cupola operation. They may be listed as 1, 2, 3 and 4.

1. In checking over the present layout several questionable features presented themselves. The first is how is the cupola drained at the end of the heat on account of the tilt upward in the tap hole. Second, if the spout is built according to the sketch there would not be sufficient iron and slag in the spout to cover the tap hole. Points *B* and *C* are shown lower than the tap hole.

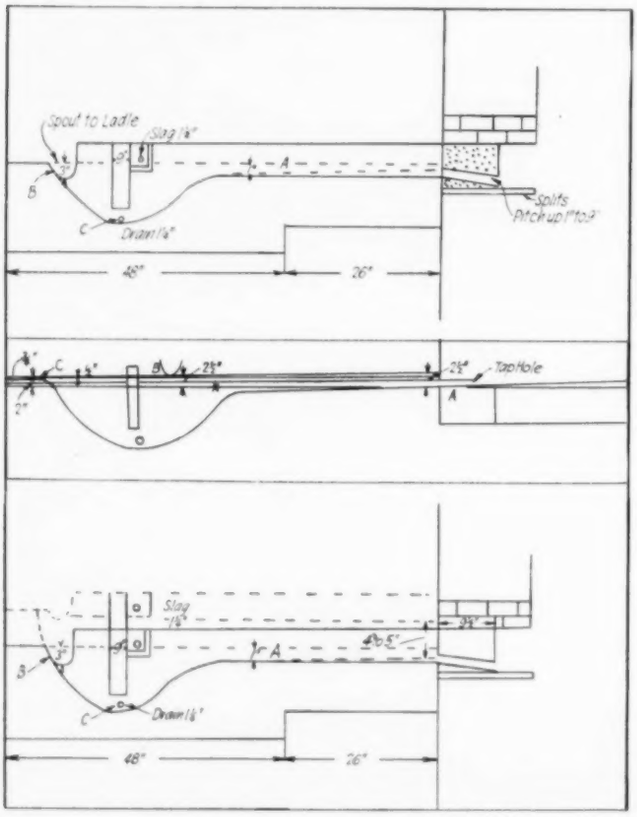
A slagging spout seen in operation recently had dimensions as shown in Fig. 2. The tap hole was level with lowest point of the sloping sand bottom of the cupola. There is a gradual slope in the spout out to the skimming basin. The spout at point *C* is about ⅜ to 1-inch higher than the top of the tap hole. The bottom of the slag spout in front of the dam is approximately 2½ inches higher than the bottom of the tap hole. This arrangement provides a head of molten iron about ¾-inch, which is necessary due to the pressure built up by the blast in the cupola. It may be necessary to adjust points *B* and *C* for best operation, but this can be done with the mud lining. Sufficient time is allowed for the metal to accumulate in the well before the cupola is tapped. This is done so that the skimming basin may be filled without draining the cupola below the level of the tap hole.

As already stated points *B* and *C* are the controlling factors and are dependent on melting rate, viscosity of the slag, fluidity of the iron, etc. If the tap hole continues to blow, point *B* can be raised ½ to 1-inch which will provide a deeper blanket of slag between the tap hole and the dam. If this does not correct the trouble, raise point *C* about ½-inch or even more if necessary.

2. A 4-inch head of iron with the slag normally on top of the metal should prevent blowing at the tap hole with 16 ounces blast pressure. From the sketch submitted it would appear that the foundryman is trying to hold the blast by the slag, as the iron spout leading to the ladle is shown below the level of the cupola tap hole. In Figs. 3 and 4 you will note that the iron outlet spout is the controlling factor in damming the iron over the tap hole. Incidentally, the size of the tap hole, so long as it is of sufficient capacity to take care of the flow of iron, is of little importance. The main point being the depth of iron outside the cupola above the top of the tap hole.

I assume that in this instance the object of front slagging is to pro-

(*Concluded on page* 64)



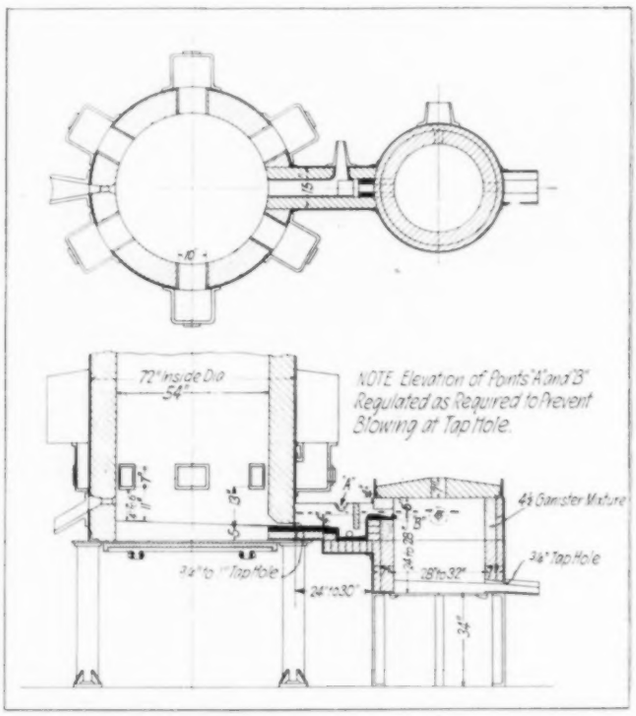

72" Inside Dia
54"
NOTE Elevation of Points "A" and "B" Regulated as Required to Prevent Blowing at Tap Hole.
4½ Sanister Mixture
¾" Tap Hole
¾" to 1" Tap Hole
28" to 32"
24" to 30"

Fig. 1 (Upper left)—The original layout. Figs. 2 and 3 (Center and lower left)—Suggested changes in the height of the metal in the spout. Fig. 4 (Above)—Sectional views of cupola and forehearth connected by spout for removing the slag

Here Is
The kind of Mold
Made on a
"HERMAN"

and a steel casting made
from it

All Photographs unretouched

HERMAN PNEUMATIC MACHINE CO.
PITTSBURGH, PA.

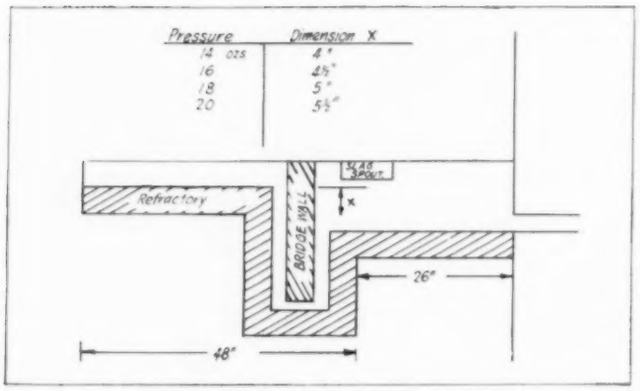


Fig. 5—The table shows depth of metal required in spout to resist various blast pressures in the cupola

(*Concluded from page* 62)

vide continuous flow of metal from the cupola. This may be accomplished by the use of two tap holes with continuous slagging at the back. Both tap holes are of a size slightly less than required to take care of the normal flow. The second tap hole is opened for a half minute or so whenever metal begins to show at the slag spout. This practice is followed at many plants. It has replaced the front slagging spout and offers the advantage of being able to hold a definite head of iron in the cupola, depending on the height of the slag hole. Generally the proper size of the holes may be determined after two or three days experiment. Usually it only is necessary to open the second tap hole once or twice in a 4 or 5-hour heat.

Favors Small Tap Hole

3. The size of the tap hole is the cause of all or nearly all the trouble. In continuous melting the tap hole should be smaller than where the ordinary periodical tapping is practiced. A 78-inch cupola will not melt fast enough to keep a 1-inch tap hole filled for any length of time. The foundryman is traveling in the wrong direction when he keeps enlarging the tap hole. I feel sure the condition grew worse as he did so. The tap hole in this instance should be reduced to a diameter of ¾-inch. If the metal is hot and fluid ⅝-inch is ample. The upward sloping tap hole does not represent good practice. It either should be straight or form a continuation of the slope on the cupola bottom.

It does not seem reasonable from any physical point of view that a pressure of 16 ounces at the tuyeres, with the greater part of this pressure dissipated on the inside of the cupola, could so far overcome the law of gravity as to prevent a head of 4 inches of molten iron from flowing back through the tap hole. Especially where as in this instance, apparently there was not enough metal inside the cupola to cover the tap hole, or to keep the slag floating most of the time, at least above the tap hole.

4. The essential feature of a front slagging spout, roughly shown in Fig. 5 is that it is necessary to make the iron run uphill. The end of the spout farthest from the cupola shell is at an elevation higher than the top level of the tap hole. The difference in these two elevations is designated as dimension *X*.

To prevent air and slag from blowing through the tap hole the static head of metal in the spout must be greater than the pressure inside the cupola. Therefore the dimensions of any given slagging spout are not fixed, but are related definitely to the operating conditions of that cupola and more specifically to the pressure. For example, on the cupola referred to with a pressure of 16 ounces dimension *X* should not be less than 4½ inches. The list at the top of the sketch Fig. 5 shows dimensions for cupola pressures of 14, 16, 18 and 20 ounces.

Design of the spout shown in Fig. 5 is quite a bit different from that shown in Fig. 1 where the dimension *B* is given as 3 inches. This design is just the reverse of what it should be for successful operation.

Successful application of a front slagging spout depends entirely on the courage displayed by the foundryman in making the spout so that the iron will have to run uphill. In many instances the front slagging spout has been a failure because the foundryman will not make the difference in elevation sufficient to seal the tap hole.

Annual Statistical Report Prepared

The American Iron and Steel institute, New York, has prepared its annual statistical report containing statistics on the iron and steel and some related industries of the United States and Canada for the year 1935 and certain preceding years. New data not previously printed include tonnage of iron and steel scrap consumed in blast furnaces and steel-making furnaces and figures showing production of stainless steel ingots in the years 1934 and 1935, supplementing the data covering tonnage of hot rolled stainless steel and other alloy steel products which are included in the total production of finished hot rolled products.

Book Review

Shrinkage, by H. A. Schwartz, 32 pages, 8⅝ x 11⅝ inches, paper, published by the Penton Publishing Co., Cleveland, and supplied by THE FOUNDRY, Cleveland, for $1 postpaid, and in London by the Penton Publishing Co., Ltd., 416-17 Caxton House, Westminster.

Shrinkage or the decrease in volume of a metal as it cools, freezes and cools further is a problem wherever metals are cast. Unfortunately, due to the complexity of the various phases entering into shrinkage phenomena, comparatively little quantitative information on the subject is available. However, in this volume which recently appeared in THE FOUNDRY as a series of articles, the author has set up a basis for an approximate quantitative treatment of the shrinkage problem. While, as might be expected, the treatment is highly technical, the author has brought each problem's solution into such form that it may be used by substituting in a formula or by reading a graph. Since the intent of the author is to develop principles for guidance in experimenting with the feeding of castings, he has simplified the treatment by limiting the discussion to simple conditions and objects.

Phases discussed in the treatise include temperature distribution in spheres enclosed in various media from 1050 to 25 degrees Cent.; shrinkage in volume; volume of void; excess of temperature required so that the feeder freezes after the casting; size of the feeder; relative heights of casting and feeder to prevent draws in the top of the casting; cooling time for castings; calculation of the length of time that the temperature will remain constant with the metal at two different superheats when poured, etc.

Soils Differ in Corrosiveness

Data on the soil corrosion specimens removed by the bureau of standards in 1934 are published in Research Paper RP883 which may be obtained from the Superintendent of Documents, Washington, for 5 cents. These data confirm earlier examinations in that soils differ so greatly in corrosiveness that average rates of corrosion or the average life of a pipe have little practical value. Certain materials seem to be especially suited or unsuited to certain types of soils.

ADVERTISING PAGES REMOVED

Names Officers of Metal Section

The National Safety council elected the following officers of its metals section at the Twenty-fifth National Safety congress and exposition held in Atlantic City, N. J., Oct. 5 to 9. Executive chairmen and their designated committees for the 1936-37 season are: C. M. Allen, American Rolling Mill Co., Middletown, O., general chairman; R. A. Chaffin, Continental Steel Corp., Kokomo Ind., vice chairman; Mell E. Trammell, Gulf States Steel Co., Alabama City, Ala., secretary and news letter editor; Robert L. Schmitt, Louisville Car Wheel & Railway Supply Co., Louisville, Ky., contests; R. H. Ferguson, Republic Steel Corp., Cleveland, engineering; Irvin A. Brinkman, Mackintosh-Hemphill Co., Pittsburgh, foundry; Dr. R. C. Engel, Republic Steel Corp., health; H. J. Griffith, Jones & Laughlin Steel Corp., Pittsburgh, membership; H. H. Henry, Otis Steel Co., Cleveland, poster; C. W. Hanko, Pittsburgh Steel Co., Monessen, Pa., program; C. E. Ralston, Pittsburgh Plate Glass Co., Pittsburgh, publicity; P. J. Brann, Pullman Standard Car Manufacturing Corp., Chicago, railway car builders; J. A. Oartel, Carnegie-Illinois Steel Co., Pittsburgh, slides and safety kinks; and W. T. Filmer, Youngstown Sheet & Tube Co., Youngstown, O., statistics.

Book Review

Directory of Materials Used in Design of Machines, fourth edition, 1936, 76 pages, published by *Machine Design*, Penton Publishing Co., Cleveland, and supplied by THE FOUNDRY, Cleveland, for 25 cents.

This comprehensive directory groups iron, steel and nonferrous alloys into a workable listing. Because of their growing importance in the design of machinery, plastics and other nonmetallic materials have been included under respective tradenames. Numerals have been used to classify the properties of the alloys and the specially processed irons and steels included in the alloy section.

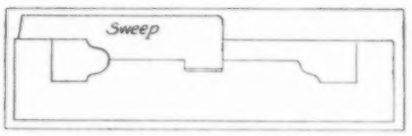
Reviews Pure Iron

According to Research Paper RP860, published by the bureau of standards, Washington, a critical review of available information on preparation and properties of pure iron, leads to the conclusion that really pure iron—iron free from significant amounts of all impurities—never has been prepared. Consequently, many of the fundamental properties of iron cannot be defined with the accuracy desirable for such an important metal. Available information on preparation and properties of the purest available forms of iron is summarized in the paper which may be obtained from the Superintendent of Documents, Washington, for 5 cents.

Making Core for a Sheave Wheel

By Martin H. Ball

The accompanying illustration shows one method of making the core for a sheave wheel which presents advantages under certain conditions. A sweep working off a dowel pin in the center forms the upper part of the core. The core is made and dried as a unit thus saving time and eliminating the fin or rough edge at the joint. Space on top is filled with black sand before the core is rolled over.



The upper part of the core is formed by a sweep working off a dowel pin

Varied Program Held In New Jersey

Members of the New Jersey Foundrymen's association met in Newark, N. J., at the Downtown club, Oct. 15, and heard a program featuring a variety of subjects. John M. Ludwig Jr., metallurgist, Electro Metallurgical Co., New York, in the principal talk, discussed the use of ferroalloys in the gray iron foundry. The need for trained men in the Northern New Jersey district was considered and the proposed class for foundry apprentices at the Boys' vocational school, Newark, was emphasized.

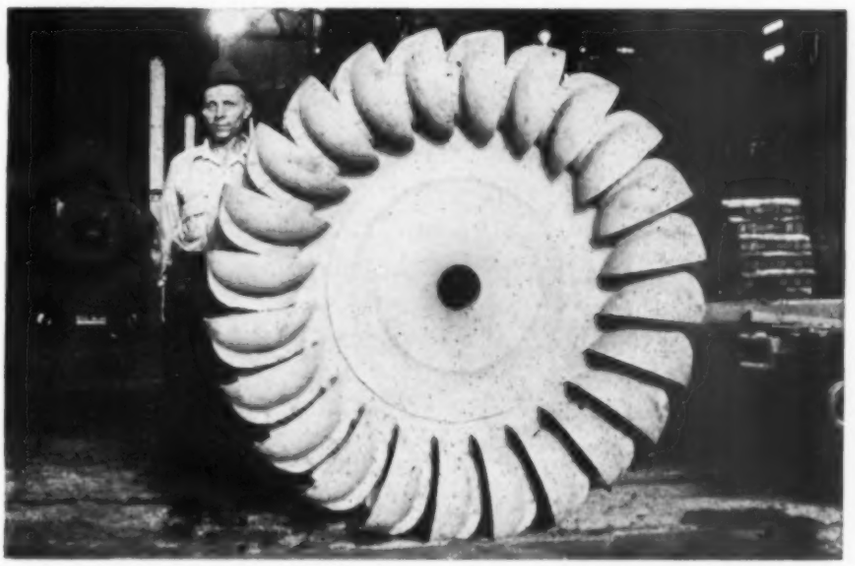
Iron Founders Meet

The greater Cincinnati Chapter of the Gray Iron Founders' society met at the Hotel Metropole on Oct. 15, with Arthur Pletz, Blackburn Foundry Co., Cincinnati, presiding as chairman. Among problems discussed were the national security act, labor survey, trend of business, group insurance and mutual aid societies.

Builds Addition

American Air Filter Co., Louisville, Ky., recently has placed a contract with the Austin Co., Cleveland, for a plant addition.

Two Ton Wheel Made of Stainless Steel



ONE of the largest and most difficult castings ever attempted in stainless steel is this impulse runner wheel, produced recently at Midvale Co.'s plant in Nicetown, Philadelphia, for the S. Morgan Smith Co., manufacturers of hydraulic turbines, York, Pa. The wheel is for use by the Puerto Rico reconstruction administration in hydroelectric plant where water containing particles of sand will be driven against it with tremendous velocity. Wheel and buckets were cast integrally of low carbon, 13 per cent chrome stainless steel, heat treated to get a tensile strength of 90,000 pounds per square inch. It weighs 3910 pounds, and overall diameter is approximately 72¼ inches.

Simplifies Cost System

(*Concluded from page* 31)

month the totals of all columns except "Sundry" which items are posted directly as covered in paragraph (5) are posted to their respective accounts in the Ledger. NOTE: After posting Debit and Credit totals of Accounts Receivable to the Ledger, *credit* Sales Account in Ledger in the same amount of Debit Total Accounts Receivable as it represents total sales for the period.

(11) The various forms enumerated have been worked out in such a manner as to represent one month's review of the majority of transactions of foundry activity. It will be noted from a comparison of the Forms that all transactions may be followed through the entire detail.

(12) On Form No. 4 "Recapitulation" the information is transferred from the respective Ledger Accounts into the proper columns which as will be noted have been numbered and an explanation shown directly under each number.

(13) The method of arriving at the cost per pound of metal will be identical, whether computed on a monthly basis or an annual basis.

(14) The example shown on Form 4 at the top is determined from a Cupola Charging report such as is now used by many foundries. As this method of reporting daily Cupola Charges has been widely distributed, a form for this particular practice has not been included.

(15) Another method is available for use in this connection, but is not at all recommended except for foundries whose production is very, very small. This method consists of taking a complete physical inventory of the materials used in charging the Cupola at the start of a period, adding all purchases during the intervening period, and subtracting the inventory at the end of the period; this sum is then divided by the total number of pounds of good castings produced between the two inventory periods, the result being the cost of the metal used. As above stated, this method is satisfactory for a small foundry where no serious problem is encountered in securing a physical inventory, but in the majority of plants, the cost of securing a physical inventory periodically far exceeds the cost of keeping an accurate cupola charging record. However, for accurate cost of melted metal, the use of both daily cupola reports and the inventory, as a check of each record, is recommended. In either practice account must be taken of the melting loss which can be determined by your own experience. This is the difference between the tonnage charged in and the total tonnage tapped out.

(16) Calculations of overhead. It will be noted that the first item (a) Account 100—Power, Light & Heat included—is taken direct from the attached Journal and distributed directly to each Department in the proportionate share of its use. (See the flow chart on page 70.)

(17) *Account No.* 110—Taxes, Insurance and Depreciation, Item (b), are annual charges; these charges should be divided by twelve (12) and shown in the General Ledger under the proper heading as a charge for each month of the year. The method of distribution used for this particular item is based on the percentage of floor space of each Department to the total floor space of the Plant.

(18) *Account No.* 111—Depreciation and Insurance on Equipment, Item (c). This item also should be set up in the General Ledger on a monthly basis.

(19) *Account No.* 101—(Workmen's Compensation)

Account No. 102—(Variable General Labor) Item (d)

Account No. 112—Administrative Expense) are distributed on

(*Concluded on page* 70)

RECAPITULATION FORM 4

	Castings on hand Feb. 28th		21,652 Lbs.
	Shipments during February		96,075 "
			117,727 "
	Less Castings on hand Feb. 1st		21,864 "
		(1)	95,863 "

Metal charged during month of February
(secured from cupola reports or inventories)

57,144 Lbs.	pig iron #1	@ 21.70 Gross Ton .969		$553.74
21,427 "	pig iron #2	@ 21.20 Gross Ton .946		202.70
19,568 "	purchase scrap	@ 10.00 (2) Net Ton		97.84
50,000 "	gates and sprues (remelt)	@ 10.00 (2) Net Ton		250.00
148,139 "	total melt			$1104.28
Less 5,282 "	melting loss (see par. 15)			
142,857 "				
Less 47,143 "	remelt iron on hand end of period @ $10.00 (2) Net Ton			235.71
(1) 95,714 "	good castings (64.7% yield)	.9074c per Lb. $18.15 Net Ton		$ 868.57

(1) The figure 95,863 Lbs., as shown by inventory and shipments, should equal 95,714 Lbs., but there is usually a slight variation due to errors in weighing.
(2) Current market price of scrap.

CALCULATION OF OVERHEAD

All charges shown are for the month of February. Account Nos. 110-111-112 are computed on an annual basis and then divided by 12 to give correct charge for one month.

ACCOUNT NO.	13	23	33	43	
Based on use of all supplies, etc., purchased during month of Feb.	Cupola Expense & Supplies	Molding Expense & Supplies	Core Room Expense & Supplies	Cleaning & Shipping Exp. & Sup.	Totals
(a) Account #100—(power light & heat included) See Journal Distribution	157.50	227.50	197.50	142.50	725.00
(b) Account #110 (taxes insurance & depreciation) 1/12 of annual	6.67	87.50	15.00	36.66	145.83
(c) Account #111 Depreciation on equipment—1/12 annual	25.00	50.00	12.50	37.50	125.00
(d) #101—Workmen's Comp'tion #102—Var. Gen'l Labor	(4.1%)	(66.4%)	(12.9%)	(16.6%)	
#112—Administrative 1/12 annual	34.17	553.33	107.50	138.33	833.33
				sub-total	1829.16
(e) Indirect Labor	110.00	800.00	100.00	450.00	1260.00
(f) Unproductive Expense Tot.	333.34	(i) 1518.33	(k) 432.50	(m) 804.99	3089.16
(g) Direct Labor		(j) 1200.00	(L) 250.00		1450.00
(h) Metal cost from top of page, .9074c Lb.	868.57				868.57
Totals	1201.91				5407.73

Cost of iron at the spout, 95,714 Lbs. of good castings 1201.91
Per pound of good castings 1.255c
Use 1.26c

Cost Estimate Sheet or Card

(a) Customer ..... Pattern No. .....
(b) Description ..... Date .....
(c) Pattern Equip. ..... Flask ..... Quantity .....
(d) Core Box Equip. ..... No. Cores per casting .....
(e) Wt. each ..... Wt. per Mold ..... Molds per day ..... Wt. per day ..... =

	Est.	Actual
Iron & Melt # @ equals		
Alloys # @ equals		
(1) Mold Price ¢ per Molds		
Molding Overhead %		
(2) Core Price ¢ per Cores		
Core Overhead %		
Cleaning Expense # @ ¢ or % of direct molding cost		
Scrap		
Extras		
Total cost		
Profit %		
Freight		
Total Sales		
Selling price per pc. or lb.		

(1) For day work put molders and helpers total pay for day in estimated column.
(2) For day work put coremakers total pay on number of cores of one day's molding.

SIMPLICITY OF DESIGN
LOW IN FIRST COST
AND OPERATING COST
YEARS OF DEPENDABLE SERVICE

SLY
DUST
CONTROL

The positive and economical way to suppress, collect and dispose of dust.

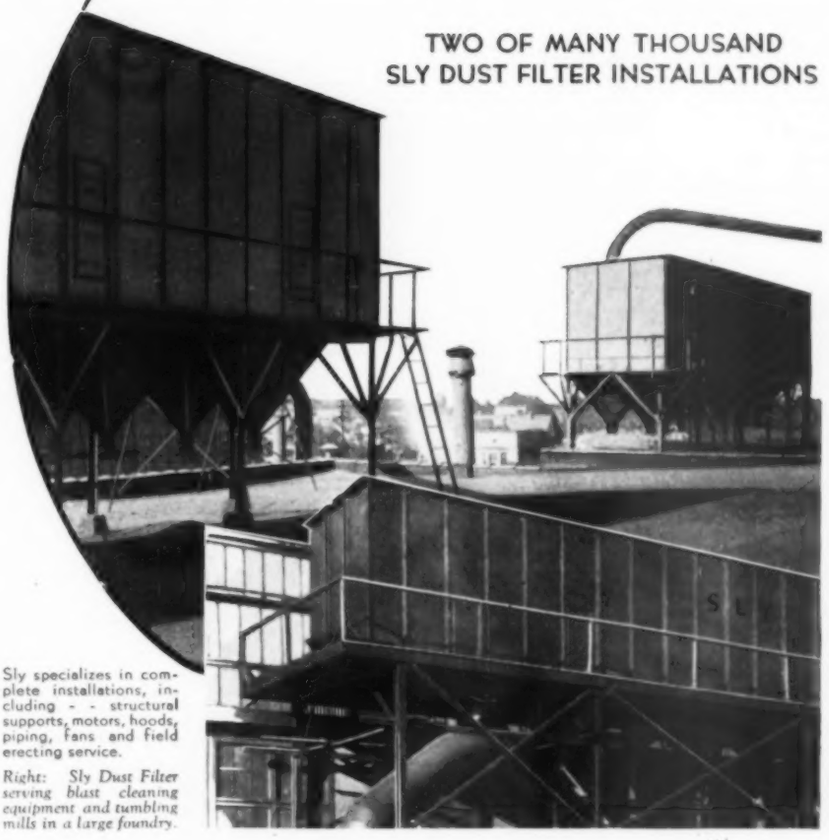
With Sly Dust Control Systems the foundry industry can solve its dust problems at surprisingly low cost.

Sly Dust Control Systems have an exclusive dust filter design. Dust is collected on the **outside** of cloth tubes or bags, flattened to conserve space, attached to a steel frame. A hook with compression spring keeps bag taut for most effective dust removal by the simplest kind of shaking device. Individual bags are quickly changed without interruption in service.

EXPERIENCE in solving hundreds of different dust problems is necessary to solve new problems successfully - - SLY HAS IT!

Write us. We will analyze your problems - - and show how the dust nuisance and hazard can be ended at low cost. There is an experienced and competent representative near you.

TWO OF MANY THOUSAND
SLY DUST FILTER INSTALLATIONS

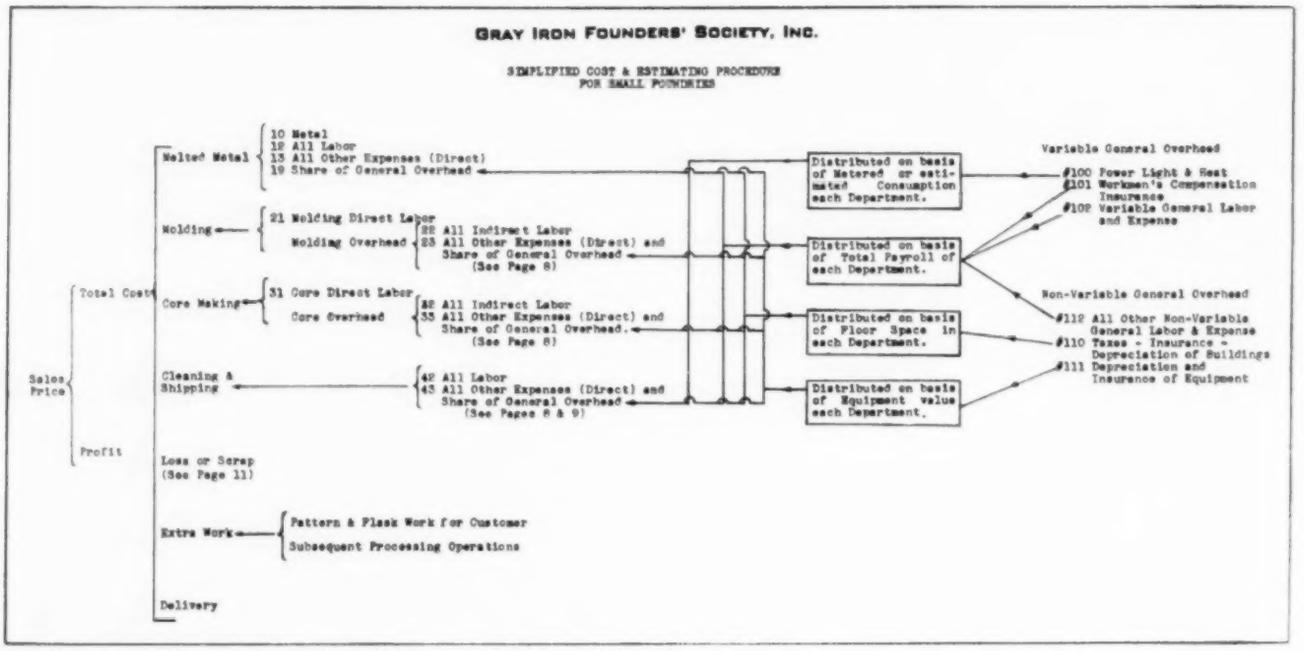


Sly specializes in complete installations, including - - structural supports, motors, hoods, piping, fans and field erecting service.

Right: Sly Dust Filter serving blast cleaning equipment and tumbling mills in a large foundry.

DUST CONTROL SYSTEMS . . . BLAST CLEANING EQUIPMENT . . . TUMBLING MILLS . . . HELMETS . . . ABRASIVES

The W. W. SLY Manufacturing Co.
4703 Train Avenue, Cleveland, Ohio.


GRAY IRON FOUNDERS' SOCIETY, INC.
SIMPLIFIED COST & ESTIMATING PROCEDURE FOR SMALL FOUNDRIES
Sales Price
Total Cost
Profit
Melted Metal
10 Metal
12 All Labor
13 All Other Expenses (Direct)
19 Share of General Overhead
Molding
21 Molding Direct Labor
Molding Overhead
22 All Indirect Labor
23 All Other Expenses (Direct) and Share of General Overhead (See Page 8)
Core Making
31 Core Direct Labor
Core Overhead
32 All Indirect Labor
33 All Other Expenses (Direct) and Share of General Overhead. (See Page 8)
Cleaning & Shipping
42 All Labor
43 All Other Expenses (Direct) and Share of General Overhead (See Pages 8 & 9)
Loss or Scrap (See Page 11)
Extra Work
Pattern & Flask Work for Customer
Subsequent Processing Operations
Delivery
Distributed on basis of Metered or estimated Consumption each Department.
Distributed on basis of Total Payroll of each Department.
Distributed on basis of Floor Space in each Department.
Distributed on basis of Equipment value each Department.
Variable General Overhead
#100 Power Light & Heat
#101 Workmen's Compensation Insurance
#102 Variable General Labor and Expense
Non-Variable General Overhead
#112 All Other Non-Variable General Labor & Expense
#110 Taxes - Insurance - Depreciation of Buildings
#111 Depreciation and Insurance of Equipment

(*Concluded from page* 68)

a payroll percentage basis. It will be noted that the percentages have been worked out, and are directly over the Departmental charges. (Check these percentages with your own payroll distribution.)

(20) *Indirect Labor*, Item (e), is the total Departmental Indirect Labor as shown in the Journal.

(21) *Unproductive Expense*, Item (f) is the total of all Monthly Expenses, Items 1 to 7 inclusive, which represents the burden of each department in the respective columns.

(22) *Melting Cost Per Pound.* By again referring to the cost of metal reported at the top of Form 4 you will note that the return for the month of February is 95,714 pounds of good castings, the melting cost per pound is $333.34 divided by 95,714 pounds which gives a melting cost of 0.3482c per pound.

(23) Item (g) is the Direct Labor of each Department for the month, and under this method is shown for molding and core room.

(24) Item (h) Metal Cost is taken directly from the Recapitulation at the top of Form 4, which shows 95,714 pounds of good castings with a total metal cost of $868.57, or a cost of 0.9074 cents per pound.

(25) By dividing the total of all Cleaning and Shipping Labor and Expense by the number of pounds of good castings produced, the answer is the average cost of cleaning and shipping per pound. Or, by dividing all Cleaning and Shipping Labor and Expense by the total Direct Molding Labor the answer is the per cent Cleaning and Shipping Cost.

(26) It must be borne in mind that these figures have been used only for the purpose of demonstration and will in no way affect any figures which you may secure from your own operation.

Explanation of Form 4 (page 68) is as follows:

Molding overhead is arrived at by dividing Molding Unproductive Expense (Item (i)—1518.33) by Molding Direct Labor (Item (j)—1200) or

$$1518.33 \div 1200.00 = 1.2652$$

or Molding Burden 126.52%

Core overhead is arrived at by dividing Core Unproductive Expense (Item (k)—432.50) by Core Direct Labor (Item (l)—250.00) or

$$432.50 \div 250 = 1.73$$

or Core Burden 173%.

Cleaning cost per pound of good castings is Cleaning Unproductive Expense (Item (m)—804.99) divided by weight of good castings (95,714 pounds) or .8410c or Cleaning Cost (Item (m)—804.99) divided by Molding Direct Labor (Item (j)—1200.00)

$$804.99 \div 1200.00 = 0.67$$

or 67.0% of Molding Direct Labor.

Explanation of Cost Estimate Sheet or Card (page 68) is as follows:

Line A, B, C and D should be filled in with information supplied by the customer on his request for quotation.

Line E can be easily filled in and the final result will show the total production per day.

Under Iron and Melt, your total weight per day, multiplied by the cost of Iron at the spout, will give you the total cost of iron for the day's production.

Under Alloy, use the weight and price of alloys necessary to make the particular casting.

Molding Cost is for a total day's production. As explained in footnote 1, if the molders are on a day work basis, the total days pay should be entered in the estimate column.

Molding overhead: Use the proper per cent as worked out on your recapitulation sheet and take this percentage of the molding price.

The same procedure is followed for core cost and core overhead (See Footnote 2).

Cleaning expense will be either the weight per day multiplied by the cleaning cost per pound, or a percentage of the direct molding cost.

Under scrap: Insert here the percentage rate which your experience teaches you will be satisfactory to cover the defective castings.

Extras: If any, such as machining, plating, enameling, galvanizing, etc., should be inserted here and the total cost shown in the estimate column.

Line marked total cost will be the total foundry cost for a specified quantity of castings. Profit is to be added at the proper percentage on the next line.

The next line is for freight, if this item is prepaid.

The line marked total sales will show the total selling price for the specified quantity of castings estimated.

The cost per pound is arrived at by dividing the total cost estimate by the number of pounds produced per day.

Chain Belt Co., Milwaukee, has established a new location for its Portland, Oreg., office at 112 Southwest First street.

ADVERTISING PAGES REMOVED

Planning Cuts Costs

(*Concluded from page* 25)

money and hours.

Overhead amounts may be shown, if desired, but must be segregated from the costs of both labor and material. In the opinion of the writer, overheads serve no purpose in these records and unless they are segregated, they cause confusion and do not assist in the control of shop labor or material costs. The writer also contends that expense or overhead falls within a different category than the usual costs of shop labor and material, and must be controlled in an entirely separate manner. He also contends that overheads are applied to shop costs, in accord with the established rates, and therefore cannot be controlled or reduced, on individual order costs, except by an amount which is proportionate to the control or reduction in labor and material costs. However, he admits that each part or even operation must bear a proportionate amount of overhead, but refrains from entering into a discussion of the methods of application and refers to the many articles and books which cover the entire subject. His objective is the control of costs and not methods of expense distribution which he leaves to the jurisdiction of the accountant.

Labor Units Shown

It is especially important that labor and material units, (pound, hour, etc.,) be shown for each cost entry on these cards, so that past costs readily may be converted into current costs by a simple multiplication of the number of units by the current unit values.

In Fig. 2, a space has been provided for listing the costs of errors or extra work which accrued during the production of the contract and that these costs are covered by charge account numbers for the departments responsible and to which the cost of the work actually is charged.

This policy prevents the inclusion of such costs in the cost of the contract and eliminates the possibility of using such inaccurate costs for future estimating and the development of selling prices. For example, if a special test on a piece of equipment is run for purely development engineering purposes, at a cost equal to the cost of the necessary test, it is only natural that this extra cost will be included in the legitimate cost of the regular test, unless some plan, at least similar to the one illustrated, is in effect and makes it impossible.

Special or extra work, made necessary by errors or desire, must be covered by *SOs*, which will clearly specify the reasons for the work, indicate the department responsible and stipulate the disposition of the costs in both labor and material. It is also worth while to have *TTs* and material requisitions, which are used for this class of work, printed on individually colored paper. Since work of this nature is considered as expense, for the individual departments charged with it, the labor and material incurred does not bear handling charges or overhead. This is a matter of policy.

It has been found expedient to compile a monthly statement of the costs of this class of work and to submit it to the department heads and the management. This report is segregated by departments and if only for the psychological effect, brought about by explanations, serves to reduce such work to a minimum.

Work Must Be Authorized

Receipt of the *SDE*, in the engineering and production departments, authorizes these departments to make drawings, issue *BMs*, and *SOs* and execute other work required for the production of the *UFAs* specified on the *SDE*. Any other work, desired or required in connection with the contract must be authorized properly, prior to execution, and provisions made for taking care of the accrued costs.

This policy positively prohibits the execution of any work on the contract except that covered by authorized *SOs*, and eliminates the common practice of permitting engineers, salesmen and executives to issue verbal instructions which may seem necessary to them but cause over-runs in costs.

The writer does not advocate the exclusion of engineers, salesmen and others from the shops, even though he believes that many of their shop visits are useless and bothersome but rather he argues for shop administration devoid of interference. When the services of these men are required, they can be requested.

It has been found to be good practice to charge extra work, not included in the *SDE*, and originating in the sales department, at the request of a contractor, to the involved sales department. The sales department then has the privilege of either assuming this cost as an expense, or billing it to the customer, all of which will discourage the practice of giving the customer more than he pays for.

Responsibility for cost accumulation will vary with the organizational set-ups of various industries, but in the plant wherein this routine functioned, it was found expedient to place the responsibility of cost accumulation under the jurisdiction of the production department.

This policy was adopted after considerable thought and from the standpoint of control, as was made possible in the production department, because of numerous responsibilities along this line, which were already under its jurisdiction. It also was decided that the production department, made up of men familiar with all phases of shop activity, were better equipped to handle this function and the results obtained fully justified this conclusion. Functions of the production department will be noted later.

Little remains to be written regarding the *CA*, Fig. 2, except that it is compiled in the cost department, is made up of accumulated costs of labor and material, as well as other identification data, but does not include over-heads.

Upon its completion, it is sent to the accounting department where overheads are added, according to the current factors, the gross cost developed and the transaction completed and compared with the *SDE*.

Copies of the completed *CA*, and the corresponding *SDE*, then are sent to the involved sales department and the management for analysis and future use, while the accounting department uses theirs for the entrance of costs, etc., into the proper accounting books and for billing the customer.

Production and cost control features or functions of this routine are not presented even though they involve many unique methods which were developed to suit local conditions.

Departmental Functions Listed

Numerous departmental functions are brought into force and planning, scheduling, inventory control, rate setting and practically all other phases of modern management are involved and function with the *SDE*, as a common basis of all activities. These departments, with their general functions, pertaining to the discussed routine follow:—

Sales department: — compiles *SDEs*, makes quotations—has all contact with customers—sends out all approval drawings—receives customer's approval—establishes *UFAs* — analizes contact — revises *SDEs* if necessary—analizes *CAs*—maintains file of completed *SDEs*.

Engineering department:—Checks quotations and contracts with *SDEs* —checks established *UFAs*—issues detail and assembly drawings—issues preliminary *UFA* and assembly *BMs*—confers with and issues work according to production department plans—supervises certain tests —establishes quality.

Production department, (Estimat-

ing division):—Compiles *SCEs* at request of sales department, for all new *UFAs*, in terms of labor and material.

Rate & methods division:—Analizes *SDEs*, and establishes rates and methods for producing parts, *UFAs* and complete pieces of equipment—investigates cost over-runs as reported each day by the cost division—authorizes jig, fixtures and tools and supervises their design.

Order division:—Issues all *SOs*, according to *BMs*,—keeps stock control—maintains status of all *SOs*—requisitions material.

Expedition Division:—Supervises centralized control—plans production—supervises movement of material—closes all shop orders.

Cost Division:—Supervise time system—calculates premiums etc.—accumulates part order, *UFA* and assembly costs—reports over-runs in costs to rate division for investigation—maintains operation part and assembly cost record—compiles *CAs* in terms of the costs of labor and material, but no over-head for accounting department.

Manufacturing department:—Manufactures all parts, makes assemblies and tests, according to the methods and operations established by the rate and methods division of the production department.

Resume of Principles

Inspection department:—Operates independent of engineering, production and manufacturing department and is subject to the general manager—maintains quality of product, approves all operation completion notices as is necessary to payment of any premium etc.

Accounting department:—Receives partly finished *CAs*, from the cost division of the production department, and completes them, by adding over-heads etc.—makes cost entries in proper accounting books and bills customer.

The foregoing represents the results of many years of application and study of principles in the system of costs and production in industries specializing in the manufacture of heavy and special equipment and involves portions of routine which it was the writer's privilege to create and install in several plants.

Fundamentally, the routine is the accomplishment of a desire to develop a means for rapidly obtaining selling prices, which would include all items of cost from labor to selling expense, and for accumulating corresponding costs, which likewise would contain all items of cost, in a manner which would make them immediately comparable without special analysis.

In addition, the routine brings about a means of cost and production control, which places all functions on an efficient basis and eliminates the customary leg-work type of execution that is found in so many plants of this type.

Finally, it can be stated from experience that the application of these principles in their entirety, made it possible to control sales department estimates in the shops in a manner which brought about a return of calculated profits.

This is the second and concluding part of an article dealing with a method for determining costs in advance, and for keeping a check on these costs as the work progresses. The first part containing typical report forms appeared in the October issue of THE FOUNDRY.

THE EDITORS

Phosphor Copper Is Deoxidizer

(*Concluded from page* 29)

Otherwise it is best to pour it into ingots.

Although phosphor copper is of great value in the brass foundry, it should not be assumed that it will cure any kind of trouble. Proper molding, gating, furnace practice and pouring temperature, to mention only a few of several important factors always are and always will be of equally great importance in the art of making brass and bronze castings. Only by taking all of these factors into consideration is it possible to produce castings perfect in every respect.

Refractories Talk Heard In Boston

Members of the New England Foundrymen's association met at the Engineers' club, Boston, on Oct. 14. Following dinner, A. S. Wright, president, introduced C. E. Bales, vice president of the Ironton Fire Brick Co., Ironton, O., who talked on "Manufacture and Properties of Fire Clay Refractories for Use in Foundries."

Mr. Bales opened his speech by describing different types of brick made by his company and pointed out reasons for brick failure. These causes he attributed to temperature, chemical erosion of the flux and slag, abrasion, spauling, breaking and erosion from too high a blast pressure. He outlined briefly remedies for these difficulties and pointed out that the life of a cupola lining depends almost entirely upon the operation of the cupola.

The speaker stated that a mixture of one part fire clay and two parts fine silica sand would be satisfactory for patching cupola lining. He spoke at length on refractories for air furnaces and discussed briefly brick bottoms and insulated ladles. Mr. Bales stated that a disk brick, placed in the bottom of the ladle when relining, was a development that had received considerable attention recently.

Hold Two Sessions At Chicago

Three papers were presented at the first meeting of the 1936-37 season of the Chicago chapter, American Foundrymen's association, held at the Medinah club, Oct. 12. Attendance totaled nearly 150, including a large representation of the nonferrous foundry industry. Separate meetings of the ferrous and nonferrous groups were conducted, the latter being addressed by George E. Stoll, Bendix Corp., South Bend, Ind. Mr. Stoll's subject was "Study of Nonferrous Castings by X-Ray To Improve Quality."

Speakers at the ferrous session discussed two papers which were presented at the Detroit convention of the American Foundrymen's association. B. C. Yearley, National Malleable & Steel Castings Co., spoke on "Measuring and Controlling Pouring Temperatures and Fluidity." This paper was presented originally by Carl F. Joseph, Saginaw Malleable Iron Division, General Motors Corp., Saginaw, Mich. Discussions by Mr. Yearley and others indicated the value of reducing radiation losses by insulated covered ladles. Effects of oxidation as well as temperature on fluidity were described.

A paper on "Effect of Tuyere Height on Carbon Pick-up in the Cupola" prepared by H. V. Johnson and J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, was reviewed by L. H. Rudesill, Griffin Wheel Co. Results of tests to determine carbon pick-up using various fuels in a small portable cupola were described. It was found that increasing the distance of the tuyeres above the sand bottom increased the carbon pick-up materially, while a higher carbon value also was obtained by intermittent flow than by continuous flow. The carbon pick-up also was found to increase with the rise in temperature of the iron, and the contact of the molten metal with the incandescent coke is affected by the degree of tenacity with which the slag clings to the pieces of coke.

Builds New Plant

Wyodak Chemical Co., Cleveland, recently has built a new plant for mining and refining Bentonite at Upton, Wyo. The new plant has a capacity of 500 tons a day anl is located on the main auto highway running from the Black Hills to Yellowstone park, and also on the Burlington railroad.

The World's FIRST *Free Wheeling* RIDDLE

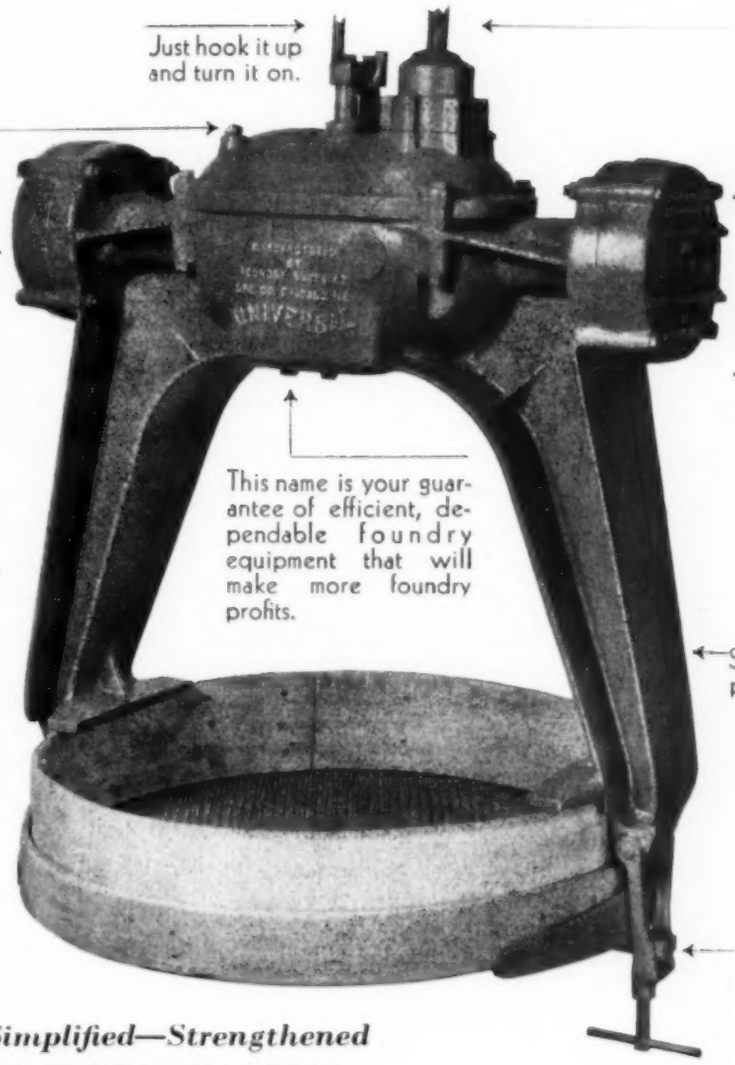
with the DOUBLE EIGHT VIBRATION MOVEMENT

Ventilated motor, with capacity far beyond full load requirements — completely dustproof.

Just hook it up and turn it on.

Just plug into any electric outlet — operating cost is ridiculously low — safety ground wire standard equipment.

Smooth action accentuates the famous Double-8 Vibration Movement, a complex chopping-and-riddling action—fine work even with coarse sieves—excellent results with ***any*** foundry sand.



Mechanism dustproof, entirely enclosed — no exposed operating parts.

New FREE WHEELING movement eliminates excessive bearing wear — no rigid construction — more violent vibration and faster work, yet smoother freer action.

This name is your guarantee of efficient, dependable foundry equipment that will make more foundry profits.

Weighs only 70 lbs.— overall height only 34 inches—one man ***actually can*** handle it easily.

Sturdy construction is coupled with light weight.

Fits the standard size foundry sieve. Sieves can be quickly, easily changed.

To remove debris from sieve, simply tilt the riddle—overall length of riddle is so short that sieves need not be detached for cleaning.

Improved—Simplified—Strengthened

YET NO INCREASE IN PRICE

$135.00 f.o.b. Chicago

115 volt A. C. single phase 60 cycles

D. C. and 3-phase motors $7.50 extra

22 Years of Vibrator and Riddle Success!

Other famous Adams products—the RED Electric Vibrator (used all over the world) and the Universal *2-Minute* Fineness Tester for both production and laboratory work.

WRITE FOR DETAILS AND PRICES

FOUNDRY SUPPLIES MFG. CO.
2221 Orchard St.
Chicago Illinois

Features Quality Castings

(*Concluded from page 23*)

the Tabor Mfg. Co., Philadelphia. The majority of these machines are equipped to both squeeze and jolt the sand in the molds.

In a few exceptional instances flasks are employed as shown in Fig. 2 but in the majority of instances the molds are made in snap flasks. In this instance the necessary depth of sand for each half mold is secured by employing two parts of the snap flask for the drag and two parts for the cope.

Castings from the molds shown in Figs. 1 and 2 are subjected to pressure test and must conform accurately to other specifications. These and many others of a somewhat similar character are poured from an iron mixture containing nickel and chromium.

As one of the factors in the production of high class castings, a certain amount of charcoal pig iron is incorporated in every charge that goes into the cupola. Naturally the amount varies to meet the anticipated analysis and physical properties required in various types of castings. A typical cupola charge of 1600 pounds contains 900 pounds pig iron, 600 pounds scrap iron, 100 pounds steel rails and 140 pounds coke. A booster charge of coke is added after each sixth charge to maintain the bed at the proper level for rapid and efficient operation. The iron is tapped consistently at a temperature of approximately 2750 degrees Fahr.

Adds New Sand to Heaps

Molds are made in Albany sand No. 1 grade and new sand constantly is incorporated in the heaps to make up for loss and maintain them in the best condition. Under present operating conditions approximately 50 tons of new sand is required per month. Core sand in several grades comes from the Michigan sand dunes and from the Ottawa silica sand district. No attempt is made to salvage any old core sand. With other refuse from the foundry it is wheeled out and spread on the dump. Supplies of molding and core sand are stored in a row of covered concrete bins, 40 x 90 feet overall, heated in winter by a hot air system originating in a small furnace in the adjoining core room.

The latest addition to the plant is an exceptionally well appointed core making department 70 x 100 feet, built of concrete blocks and steel and covered by a fireproof arched roof. The walls are made up principally of windows provided with sectional swinging sash to regulate ventilation. Wall columns and ceilings are painted white and constant effort is made to maintain the interior in a clean and orderly condition.

Smoke and odors from the core ovens are exhausted through large steel hoods suspended over and in front of the oven doors as shown in Fig. 4. Stacks on top of the hoods carry the smoke through the roof. The battery of ovens include a pair made by the Foundry Equipment Co., Cleveland, and two pairs built on the premises by the Keen Foundry Co. according to the special design of the president. The first pair referred to is of the roller drawer type, while the second pair is served by a car on one side and removable racks on the other side. Bars fastened to the uprights on the car may be adjusted to accommodate cores of various heights.

Cores Dried on Racks

The second two pairs of ovens are fabricated from welded sheet steel with double wall and roof containing a 4-inch thickness of rock wool insulation. Cores in these ovens are dried on racks carried in and out on a lift truck. A high degree of efficiency is claimed for these ovens where a uniform temperature bakes the cores as thoroughly on the bottom tiers of the racks as it does on the top. This desirable condition is secured through a combination of factors, including the firing system, a brick floor and the thorough insulation.

An individual firing chamber is located at the back end inside each oven. In each pair of ovens one firing chamber is at the right and the other at the left, that is on each side of the division wall. The firing chamber is roofed and the products of combustion enter the oven through two openings several inches above the floor level, one at the front and the other at one side. Fuel for the oven is run of mine soft coal fed to the firing chamber through an automatic stoker made by the Whiting Corp., Harvey, Ill. Coal in predetermined volume enters the firing chamber at the bottom. A small fans blows a current of air over the incandescent fuel and through the openings in the firing chamber inside the oven.

The ovens occupy space at one side of the core room, with a gangway between the rear of the ovens and the wall of the building. Stokers are located in suitable wells in the floor immediately back of the firing chambers in the ovens and with the tops at a convenient height for the reception of coal charges from a wheelbarrow. Flues from the entire battery of ovens extend under the floor to a long transverse flue extending along the base of the building wall and are served by a single stack erected at approximately the center of the line. It is claimed the stoker method of firing presents many advantages including efficient combustion and low operating cost.

In addition to the wide range of cores employed to form the interior of various castings, certain dry sand cores also are employed to form the exterior of castings presenting features which involve a hazard in green sand. The small air cooled cylinder shown in Fig. 3 is fairly typical of this class of castings. The split pattern with runner and gates attached is mounted on cope and drag plates as shown and the two frames are packed with core sand. Later the dried half cores are assembled accurately in pairs by circular recesses on one joint face and corresponding circular projecting sand members on the other face. These cores and others of a somewhat similar character are produced on small jolt machines in the core room.

Majority of the cores are rammed by hand on a bench extending along the greater part of one side of the core room. The coremakers place the cores on convenient stands close to their benches and attendant's place the cores on the racks for transport to the ovens. Racks of baked cores are removed from the ovens and taken to the opposite side of the core room, where they are unloaded, inspected, and in many cases assembled into various combinations. The rubber tired wagon shown in Fig. 5 is employed for transporting the finished cores to the various molding floors.

Bibliography Is Published

The technology department, Carnegie Library of Pittsburgh, recently has published a 68-page bibliography on iron and steel wire. The work which is divided into three sections was compiled by Ralph H. Phelps, and the first section lists articles and books relating to general and miscellaneous phases. The second section is concerned with literature on manufacture while the third contains material relating to properties.

Independent Foundry Supply Co., Los Angeles, has completed its new building at 2325 East Thirty-eighth street, Los Angeles, providing increased office and production space.

ADVERTISING PAGES REMOVED

Gray Cast Iron

(*Concluded from page* 33)

(6) At lower loads there probably is some compacting of graphite flakes by adjacent matrix. Beyond a certain limit of compaction, the flakes cease to act as voids and offer resistance to compression. This causes formation of more and more overstressed paths with increase in load, hence, as shown in Fig. 130, Curve A, increase in amount of set is proportionately greater than increase in loading.

Discontinuous hard particles, such as certain steadite formations probably have a somewhat similar effect. When a hard component is practically continuous (as for example cementite in white and heavily mottled iron) this itself carries most of the load, resulting in the type of stress strain diagram shown in Fig. 131. Such material shows little plastic deformation.

(7) Resistance to permanent deformation or set depends on the nature and degree of continuity of the matrix. The latter is affected by the amount, size, shape and distribution of the graphite flakes. In a general way resistance to permanent deformation in gray irons is proportional to the tensile strength.

(8) This "cold working" of gray irons does not materially increase its breaking strength. The actual amount of plastic deformation at loadings of 25 per cent of the ultimate strength may amount to about 0.0002-inch per inch in very low strength irons. This set usually is less in stronger irons and in the case of very high strength irons it may be negligible. For example in a metal possessing 90,000 pounds per square inch tensile, the stress strain curve approaches a straight line through the greater part of the diagram.

Shows Physical Properties

Fig. 130 shows actual test results on an iron, showing the ordinary stress strain diagram, *B;* the permanent set at various loads, *A*, and the elastic stress-strain curve, *B-A*, constructed by subtracting the permanent set, *A*, from the total deformation, *B*. In this experiments a number of bars were cast 1.2 inches diameter. The curve *B* is constructed from results ascertained on a 6-inch gage length. The curve *A* is constructed from test results on 5 bars, each with gage length of 8 inches, and the *sets* measured in the tests.

The ultimate strength of this material was about 28,000 pounds per square inch. It is noteworthy that curve *B-A*, constructed as indicated is a straight line up to and including 65 per cent loading. The *true* modulus of elasticity is about 15,000,000, which is considerably higher than would be obtained by an evaluation of *apparent* modulus from curve *B*. In all cases sufficient time (over 24 hours) was allowed in the set determinations to allow for minor time *hysteresis* usually observed.

Book Review

La Fonte Malleable, by E. Schuez and R. Stotz, paper, 486 pages 6¼ x 9½ inches, published by Dunod, Paris, France, and supplied by THE FOUNDRY, Cleveland, and in Europe by the Penton Publishing Co. Ltd., London.

Translated from the original German into French by Rene Castro, this volume covers in a thorough manner the theory and production of malleable cast iron. It is divided into six main divisions in which the first describes the historical phases. The second section is entitled "Scientific Fundamental Data," and discusses metallography of white iron for malleable transformations by heat treatment, decarburization, and influence of the various elements accompanying iron.

The third section deals with the technology or production of malleable cast iron and describes the foundry and melting units available, molding, finishing, physical and mechanical properties and methods of test, electrical, thermal and chemical properties. The fourth division discusses the establishing of a malleable foundry; the fifth proper cost accounting, and the sixth is a list of European producers of malleable cast iron.

Detroit Foundrymen Hear Utley

Following a summer of golf meetings, members of the Detroit Chapter of the American Foundrymen's association met Oct. 15 for the first of the year's technical meetings, at the Fort Shelby hotel, Detroit. Immediately after dinner, S. Wells Utley, president and general manager of the Detroit Steel Castings Co., Detroit, delivered the principal address of the evening on "The American System—Shall We Destroy It?"

Jersey Nonferrous Founders Meet

L. A. Behrend, superintendent of the American Crucible Co., Shelton, Conn., was the principal speaker at the Oct. 22 meeting of the North Jersey Nonferrous Founders association, held at the Essex House, Newark, N. J. Mr. Behrend spoke on how the chemical composition and process of manufacture affect the life of crucibles and how proper treatment in the foundry can increase materially their average life. Mr. Behrend's speech was followed by a lively discussion. The nonferrous organization was formed approximately 3 years ago.

Handles Molds on a Transfer Car

AN interesting method is employed in handling molds from the machines to the pouring and shakeout stations in this gray iron foundry. Completed molds move down the central conveyor to the roller conveyor equipped transfer car in the foreground, and then are transferred to any one of three storage lines or to the pouring and shakeout line. Illustration courtesy Mathews Conveyer Co.

Congress Holds Interest

(*Concluded from page 27*)

ings started with an operatic selection, which showed the visitors that Germany well deserves her musical reputation.

Director W. Bannenberg, Yale & Towne Mfg. Co., Velbert, president of the committee of German foundry associations and of the Verein Deutsche Giessereifachleute, the German foundrymen's association, was in the chair at the opening meeting. Director Bannenberg, with Dr. Geilenkirchen, director of the Verein Deutscher Eisengiessereien, the German association of foundry firms, was mainly responsible for the organization of the congress. He was supported at the conference table by J. Leonard, president of the Belgian foundry association and president of the International Committee of Foundry Technical Associations, and by M. Langenohl, director of the foundries of Deutsche Eisenwerke A. G. and of the federation of foundry industries.

Director Bannenberg gave the opening address of welcome to the visitors, to which President Leonard replied in the name of all the foreign foundry associations. Previously, Mr. Leonard had sent a telegram of greetings to Herr Hitler, Reich chancellor, which telegram was read, together with the reply received from the leader. Director Langenohl then thanked Dr. Schacht in the name of the foundry industry for personally attending the opening meeting.

Greetings Are Extended

Dr. Schacht then addressed the meeting and brought a message of greetings from the German government. He expressed the wish that the work done in co-operation during the congress would benefit the industry, and emphasized the desire of the German people and their leaders for world peace. Dr. Schacht was followed by the Oberbuergermeister, or mayor of Dusseldorf, Dr. Wagenfuehr, who extended to the delegates an address of welcome on behalf of the city corporation. This meeting then ended with the orchestra playing the overture to Der Meistersinger.

After the meeting, a short preliminary visit was paid to the exhibition, and a little later all the delegates assembled in the Rheingold room of the Rheinterrasse, one of the specially-constructed buildings along the Rhine, where they were entertained at a luncheon, at which Dr. Schacht was present. The afternoon was left free for visiting the exhibition or sightseeing.

During the same afternoon the International Committee for Cast-Iron Testing Methods held its meeting, with J. Leonard presiding. Members of the committee who are also members of the International Association for Testing Materials were present, and a program of work was discussed with a view to preventing the overlapping of the two organizations, and unnecessary duplication of work.

Later in the afternoon the International Committee of Foundry Technical Associations held its annual meeting, with J. Leonard, president, in the chair. The American Foundrymen's association was represented by Thos. W. Pangborn and V. Delport. The calendar for forthcoming congresses was adopted as follows:

1937 Paris, France Congress C
1938 Warsaw, Poland Congress C
1939 London, England Congress A
1940 Milan and Rome, Italy Congress C

At the end of the meeting, V. Delport was elected president of the International Committee for the year 1937, and Germany was designated as the country to appoint the vice-president for the same year. Following the meeting, the delegates were entertained at a dinner given by the officers of the German foundry associations.

The technical sessions were held in the mornings of Sept. 18, 19 and 20. Papers were divided into two groups and were presented in two different rooms. In both cases the attendance throughout the meeting was uncommonly good. Official exchange papers were presented by the technical associations of Austria, Belgium, France, Great Britain, Italy, Poland, Czecho-Slovakia and the United States of America. A review of the principal papers presented follows this report.

In the afternoons, opportunity was given to visit a large variety of foundries, including the foundries of the Yale & Towne Mfg. Co. at Velbert and of the International Harvester Co. at Neuss. A pipe foundry was inspected at the works of Deutsche Eisenwerke at Gelsenkirchen. Steel, malleable and nonferrous foundries were also included in the program. At the works of the Gutehoffnungshutte at Oberhausen, an opportunity was afforded visitors to descend into a coal mine to a depth of nearly 400 feet.

Special mention should be made of the visit to the Kaiser Wilhelm institute at Dusseldorf. This is a complete research organization for iron and steel, set up and maintained by the Verein Deutscher Eisenhuettenleute, or association of iron and steelworks. It comprises a large, modern building, in its own grounds, in which can be seen all the most up-to-date plant equipment for testing, analyzing and generally investigating the behavior of steel and iron, cast, rolled or stamped, or in the raw state. It is certainly one of the most, if not the most, complete research laboratories of its kind anywhere.

More works visits were organized during the post-convention tour, which took members from Dusseldorf to Berlin and back, through various industrial districts of the country. At the same time an opportunity was given of seeing different aspects of the German countryside and of visiting a few of the old cities, such as Dresden, Nurnberg, Munich, Stuttgart, and Heidelberg.

Addresses Feature Last Session

The formal closing session of the congress took place in Berlin on Sept. 25. Director Bannenberg gave an address of farewell to the members, to which president Leonard replied on behalf of the various foundry associations. Prof. Dr. Ing. Arnhold then gave an address entitled "Men and Machinery in German Foundries," in which he explained the ideals and methods of working and operation of German foundries as they have been developed in the past three years. He laid particular stress on the relations between employers and workers and on the social aspect of the problem. After the delegate from each country had been given the opportunity of saying a few words, the evening concluded with a banquet and a dance, during which new friendships were cemented. On the previous day the delegates had been received at the Berlin town hall by Herr Hitler's delegate and mayor of the city. The following morning, the heads of each delegation accompanied president Leonard, who laid a wreath on the tomb of the Unknown Soldier.

The exhibition which was held at Dusseldorf in conjunction with the sixth international foundry congress was recognized on all sides as being one of the finest and most comprehensive foundry exhibitions held to date. The covered space occupied was about 18,500 square yards, of which nearly 3500 square yards were taken up by educational and technical exhibits. There were 170 exhibitors.

Considerable importance was given to the educational and technical exhibits, the arrangement of which was methodically planned under the supervision of Dr. Ing. Geilenkirchen, director of the German foundry association, and Dr. Ing. Otto Ebling. This technical exhibit was divided into four main

(*Continued on page 82*)

Upper Picture:
Two Modern Cranes 26 ft. span, two tons capacity, with air hoists for making bath tub molds at the Rundle Manufacturing Co., Milwaukee. One man transports and closes a mold without assistance, even without chain propulsion.

Inset Picture:
A 27 ft. two ton Modern crane used for charging malleable iron furnace at the Milwaukee Malleable & Grey Iron Works, Milwaukee. Hard labor eliminated; handling costs greatly reduced.

MODERN

METAL POURING DEVICES CRANES MONORAIL SYSTEMS

. . . No lost motion
nor a moment wasted

Modern Pouring Equipment Crane and Monorail Systems, keep every operation right up close to the job. Overhead is reduced. The workman's labor lessened. Production cost is decreased. Profit per job increased greatly. There is no lost motion nor even a moment wasted with Modern Equipment installed; because of Modern design and patented features of detail operation, and because Modern apparatus and installation are furnished to fit each requirement specifically.

One important way to meet and beat present new business competition is to install Modern Equipment: for the greater economy and higher efficiency; and the increased output possible without increased plant expansion and cost. Besides, Modern I Beam systems are standard and can be added to economically.

Write now for details regarding the superiorities of Modern Pouring and Ladle Equipment, Crane and Monorail Systems; with Modern service of plant layout, hookup, design and installation. Complete information and attention given on request.

MODERN EQUIPMENT COMPANY

DEPT. 125
PORT WASHINGTON, WIS.

MODERN

Covered and Insulated Ladles

Lifetime Geared Ladles

Improved Bottom-Pour Ladles

Metal Pouring Systems

Crane and Monorail Systems for Metal and Mold Handling

Furnace Charging Cranes

Sand Conditioning Systems

MODERN EQUIPMENT CO.

(*Continued from page* 80)

parts, each of which was divided into sections. Each of these sections was arranged and supervised by a specialist in the particular branch dealt with.

The first part covered general organization, education and training: it included the following sections:— (1) Organization of a foundry and preparation or planning of the work; (2) heating and lighting; (3) production of energy; (4) arrangement of the plant and equipment and handling of materials; (5) planning and construction of a foundry; (6) foundry literature; (7) safety and "beautifying" of work; (8) training of apprentices and engineers. In each section the exhibits consisted of charts, drawings, models and literature, giving a complete idea of the material organization of a foundry and of the training and management of the men.

The second part, dealing with the various products of a foundry, comprised the following sections:— (9) Nonferrous castings; (10) malleable castings; (11) steel castings; (12) centrifugal castings; (13) gray iron castings; (14) chilled castings and rolls; (15) die castings. In each case, numerous examples of typical castings were shown; many castings were cut to show the fracture; examples could be seen of all the various alloys, ferrous and nonferrous, such as are used commercially today.

Metal Testing, Control Covered

The third part was devoted to control and testing of metals, castings and materials. The various sections were:— (16) Mechanical tests; (17) X-ray examination; (18) chemical and metallographic examination. The various apparatus used in the testing laboratory was displayed, together with test-pieces, rejected castings showing defects, charts, etc. The X-ray exhibit was of special interest, this method of testing having reached a certain development in Germany.

The fourth part was concerned with processes of manufacture and plant, and included:— (19) Pattern-making; (20) design of castings; (21) mold and core making; (22) molding materials including molding sand, core sand, core oils, blackings, etc.; (23) drying of molds and cores; (24) molding machines; (25) pig iron, scrap and other raw materials; (26) melting plant; (27) technique of iron casting; (28) a section on gas producers; (29) after-treatment of cast iron; (30) surface treatment of castings; (31) enameling; (32) welding. Each section contained actual equipment, or models, or full-scale wall drawings and charts, showing the complete process of making castings from the raw material to the finished product.

All these exhibits were furnished by the various technical institutions, by the works' research departments, organization bureaus, and by actual castings supplied by the works. After a visit to the technical exhibits, one could not but be impressed with the huge development of the foundry industry in modern times, and the intricacy of the work involved in making castings. That such an exhibit is possible is in itself a tribute to the industry, and an outward sign of the prestige that it has gained in recent years.

The foundry exhibition proper was of considerable interest. It comprised foundry plant and equipment of every description, and exhibits of actual castings. Near the entrance, one hall was completely occupied by the impressive display of Badische Maschinenfabrik und Eisengiesserei, of Durlach, the main feature of which was a large dual jolt ramming molding machine, specially constructed for preparing the drag and cope of bath tub molds. Molding machines, sand-preparing plant, various types of melting plant, cleaning plant, conveyors and hoists, laboratory equipment, including a spectacular display of optical instruments, foundry requisites, raw materials—all the requirements of a foundry were shown in one form or another, and in many cases in full-size plant in actual operation.

Among these many exhibits could be seen Nicholls molding machines on the stand of Aktiengesellschaft der Eisen- und Stahlwerke vorm. Georg. Fisher, of Singen; Pangborn dust arresters and blast cleaning equipment on the stand of Breitenfeld und Scholz, Eisengiesserei und Maschinenfabrik, of Bunzlau; a wheelabrator on the stand of Berger & Co., Maschinenfabrik und Eisengiesserei, of Bergisch Gladbach.

A considerable part of the exhibition was devoted to a display of castings, small and large, and, in fact, a feature of the show was the extra large and heavy castings, such as ingot molds, heavy machine tool frames and bedplates, rolls, etc., shown by such firms as Deutsche Eisenwerke, A. G., Rheinmetall-Borsig, A. G., Bochumer Verein Gussstahlfabrikation, A. G., Demag Aktiengesellschaft, Ruhrstahl, A. G., etc. An exhibit of meehanite castings was also displayed on the stand of Gebr. Eickhoff Maschinenfabrik und Eisengiesserei, of Bochum.

One room was devoted to a retrospective exhibit of ornamental castings and back-plates for fireplaces dating back to the fifteenth century.

The following papers are briefly summarized, in the order in which they were presented at the meetings. A number of papers, of which the text is not yet available, will be reviewed in a later issue.

"Metallurgical Principles of the Manufacture of Foundry Pig Iron by a New Melting Process," by Prof. Dr. Ing. Von Max Paschke and Eugen Peetz, of Clausthal. The following procedure has been adopted for the utilization of poor, siliceous ores. The ores are treated in the blast furnace with limestone added in such amounts that, besides a fluid acid slag, a pig iron high in sulphur is produced, which will be desulphurized after tapping by a basic slag or other adequate means. By reducing the amount of limestone added, both the volume of the resulting slag and the coke consumption are considerably reduced. By means of this process, foundry pig iron and other grades can be produced.

Add Soda Ash in Ladle

It is recommended to desulphurize immediately after tapping by the use of soda ash, which is added in the cupola ladle before pouring the iron. In the case of very high sulphur contents, desulphurizing is carried out in two stages, using the slag from the finishing desulphurization for the preliminary treatment. Densely-burnt fireclay bricks with medium alumina content are specially suited for lining the ladle. Synthetically-produced high-sulphur foundry pig iron shows, after desulphurization, a pearlitic structure with finely-distributed graphite.

"Cast Iron and Its Present Position as a Material of Construction," by Prof. Dr. A. Thum, of Darmstadt. Materials with ever increasing strength value are necessary nowadays to keep in step with the progress made in modern machine construction. Strength, however, is not the only important factor. The tensile strength of a structural part is not only dependent on the material itself, but also on the design. From this point of view, testing methods also have been subject to modifications. High tensile and elongation values give an indication of the soundness of the material only. For the determination of "desi g n strength," or strength in relation to a particular design, the sensitivity to notch effect is of paramount importance. Another requirement in modern construction is that a material must be easily deformed into every desired shape, with a view to obviating local discontinuities in the flow of forces, which would cause internal stresses. It is pointed out, in particular, that in the case of fatigue failures, fracture occurs without any previous deformation.

Cast iron, with its low elongation values, has much to recommend it.

(*Continued on page* 85)

ADVERTISING PAGES REMOVED

(*Continued from page* 82)

Cast iron can be considered as an inherently notched material, and is much less sensitive to exterior notches than steel. This is of great advantage for structural parts under repeated stresses. Furthermore, cast iron is easily deformable when cast; it has a high tensile strength and only a slight tendency to piping and shrinkage. As advances are being made in design, high-quality cast iron can be used to a fuller extent by taking advantage of its outstanding characteristics.

"What May Foundry Practice Expect from Molding Machines?" by Prof. U. Lohse, of Jena. The molding machine is a machine tool, where the pattern-plate represents the tool and the molding sand may be considered the material to be worked. To obtain faultless molds, a well-prepared molding sand is necessary. The ideal sand composition is discussed and ways are shown to approach it. In practice, with trained men and in continuous operation, it is required to produce a certain number of faultless molds per unit of time. The theoretical fundamentals of molding machines and their application for different kinds of castings are discussed, special consideration being given to possible sources of defects.

Statistical Control Discussed

The conventional means of mechanical sand compression are critically reviewed, such as ramming, jarring or slinging. Selecting one or the other method depends upon the dimensions and the shape of the pattern. The surrounding of the machines is of considerable importance, as well as their operation by trained men, if long service and accurate performance are to be ensured.

"Modern Statistical Foundry Management," by Dr. Herbert Antoine, of Berlin. Statistics have found a new field of application in modern methods of industrial control; they are particularly useful in view of the possibilities of obtaining quick records. In order to keep the statistical work within reasonable limits, it is first of all necessary to establish a clearly-outlined working scheme.

An approved plan for a foundry, with a list of the most important groups of data to be compiled, is explained. The starting point is the statistical control of the staff, showing the number present each day; a classification of the workmen is also given. A statistical control of wages rates is essential, and completed by a set of curves or charts.

A statistical control of the flow of raw materials is necessary, showing purchases, prices, withdrawals from stock, etc. The daily production should be ascertained by means of a foundry report. Comparisons of actual performance with estimated, average, or should-be performance is recommended. A check on rejected castings should enable the rejections to be traced to individual workshops or departments. Rejections should be analyzed and causes registered and frequency curves established. Rejections in relation to weight of castings is an interesting factor.

Statistics further are applied to finished stock, turnover, orders on hand, etc. They are also applied to cost accounting and bookkeeping, and graphs are freely used.

"Contribution to the Estimation of Binding Agents in Molding Sands," by Dr. Ing. Schneider, of Clausthal. Classifying foundry molding materials according to their clay content only, is not sufficiently precise. The colloidal proportion, and not the clay as a whole, is the deciding factor. In addition to the amount of bond, determinable by the well-known flotation method, other variables, such as grain size, grain surface and the shape of the grains, are important.

The bonding materials of three different grades of sand were isolated: They then were converted into synthetic sands by adding in all three cases the same grade of quartzite. The resulting sands were compressed at varying degrees of moisture and tested for compression strength. Simultaneously, the three original grades of sand and a further synthetic sand (as a comparison sample), which received the same amount of bonding material as the respective original sands, were tested, too.

It was found that of the three types of bonding materials, that with the highest colloidal content was the most inferior in quality, whereas that with the lowest colloidal content showed the best qualities.

"The Physical Properties of High-Chromium Cast Alloy Steel," by Dr. Ing. Roesch, of Remscheid. The most commonly used chromium cast alloys have the following composition: Cr, 25-32 per cent; C, 0.30-1.50 per cent; Cr, 14-16 per cent; C, 0.10-0.30 per cent. The structure of the alloy with 25-32 per cent chromium consists of chromium ferrite and chromium carbide. It has been stated that this alloy does not undergo a structural transformation by annealing, and the properties cannot be improved in this way. The 14-16 per cent alloy responds to heat-treatment.

A most important feature of chromium cast steel is its resistance to acids. The chromium and the carbon content account for this resistance. There are three groups of chromium alloys: The first comprises the ferrite-carbide-chromium alloys which are of the completely stainless type without heat-treatment; the second group comprises alloys which are rendered resistant to corrosion by heat-treatment or by polishing the surface; the third includes chromium alloys that corrode heavily, but have good resistance to wear. Chromium alloys are also resistant to scaling.

Creep tests have shown that the alloys are rather brittle at low temperature, but ductile at above 500 degrees Cent. The addition of nickel increases the creep strength. The bearing properties of chromium alloys are not good. As regards castability, the 30 per cent alloy, particularly with about 1 per cent carbon, behaves like malleable cast iron. The 15 per cent alloy behaves more like cast steel. For the melting of high-chromium alloys, the acid furnace especially the high-frequency furnace, is preferred.

"Development and Present Position of Nonferrous Metal Alloys in Germany Since 1933," by Dr. Ing. W. Claus, of Berlin. Various government schemes and the resumption of armament work in Germany have stimulated a considerable demand for certain raw materials. Two particular requirements were involved: (a) Those based on technical and constructional considerations; (b) those based on considerations of economy and efficiency. The trend of development was toward the use of "replacement" materials. Advance on such lines was made in the use of light alloys, such as aluminum and magnesium alloys, and also of alloys of copper, nickel, tin, lead, zinc. The lines of further advance in the economical and efficient use of such alloys are given.

Reviews Light Alloys

"Recent Developments in the Manufacture of Light Alloy Castings," by Dr. Linicus, of Dusseldorf. The production schedules of the leading light alloy foundries of Germany comprise nearly 50 different types of alloys. The selection of the most favorable material for a given use is not always easy. Since the development of casting materials has come almost to a standstill as far as analysis is concerned, a standardization of the new alloys has been carried out recently. A review of these alloys and their uses is given.

As regards the melting practice of aluminum alloys, attention is directed to the improved practice in using returned scrap properly controlled. Progress in the design of special melting furnaces has been made. Progress in molding and pouring methods has enabled larger units to be cast in light alloys. The after-treatment of such alloys

has also been greatly developed. Surface treatment for resistance and appearance is now being developed.

"The Kinetics of the Oxidizing Action in Molten Zinc, Lead, Silver and Copper," by Prof. Dr. Ing. Krupkowski and Ing. S. Balicki. This was the exchange paper of the Polish foundry association. It deals with the investigation into the kinetics of oxidation of liquid metals in the air at constant temperature, the selection of crucibles and experimental difficulties, and the use of an hydrogen atmosphere during the melting period.

It was found that the process of oxidation is influenced by: (1) The resistance at the contact area of the liquid and gaseous phases; (2) the diffusion resistance of the nitrogen layer on the metal surface. The substantial difference between the oxidation rate of copper in pure oxygen and air respectively was shown. Mention was made of the phenomenon of vaporization of metals, and of the limitations of the method described due to this factor.

"Properties, Use and Manufacture of Lead-Bronze," by Ing. Hohne, of Leipzig. Reference is made to the difficulty caused by the tendency to segregation of the lead-copper base alloys. This may be overcome, either by a special melting method consisting of first heating the copper-lead alloy at as high a temperature as possible and holding it before pouring, or by adding an alloying element—or by a combination of the two methods.

Describes Lead and Tin Effects

Lead bronzes are better cast in green sand molds with as many chills as possible. The fields of application of these bronzes are: Bearing materials, pressure-resisting materials, materials which must resist to the attack of sulphuric acid or water containing sulphurous acid. The effects of varying proportions of lead and tin on the properties of the alloy are described.

"The Use of Scrap in Aluminum Foundry Practice," by Dr. Irmann, of Neuhausen, Switzerland. When scrap is utilized in aluminum foundry practice, the final characteristics of the alloy obtained must be established. Chemical analysis cannot always be effected in the foundry, and the pouring test is not always sufficient. Other characteristics, such as castability, shrinkage, etc., are not always practicable. Mechanical characteristics also have some importance.

An attempt has been made to draw up tables of combinations of alloy scrap showing those which are mechanically utilizable and those which are not. Three main classes are given: (1) Alloy scrap that can be mixed in all proportions; (2) scrap that can be mixed only in certain proportions; (3) scrap that cannot be mixed at all. Examples of the effect of mixing certain scrap compositions are given, and it is shown that even when the compositions are known, special technical knowledge is required in order to decide whether they can properly be mixed. A simple means of effecting a bending test showing the elastic and plastic properties of a cast alloy is given. That test can be used instead of the regular tensile test, and enables a classification to be made of alloys cast from scrap as compared with alloys of known standard.

"Character of the Surface and the Surface Qualities of Cast Iron," by Professor Diepschlag, of Breslau. The surface characteristics of a gray iron casting are of great importance. A rough surface calls for increased cleaning costs. A good skin is a protection against chemical reactions; it has a relation to certain strength properties of the casting; it is of great importance when enamelling or some other form of coating is to be effected.

The author discusses the results of surface examination from two aspects: the exterior metallic layer, and the nature of the skin of the casting. The exterior metallic layers are generally of a lower content in silicon and carbon, but the sulphur content is generally higher than in the body of the casting. As a result, the hardness and brittleness of the outer layers is somewhat higher than the inside. The influence of molding sand on the skin of the casting is referred to, and precautions to avoid the sand burning into the surface of the casting are mentioned.

"The Mechanical Properties of Cast Iron in Relation to Wall Thickness and Its Position in the Iron-Carbon Diagram," by Prof. Dr. Ing. Von H. Uhlitzsch and K. Appel, of Friberg. As a result of the investigations of Heller and Jungbluth, a diagram has been developed from which direct readings of the values of relationship between wall thickness and ultimate strength can be taken. The present study has been made with the aim of determining law-obeying correlations between the wall thickness and other tensile properties.

Following the work of other investigators, tenary diagrams have been prepared in which the wall thickness has been plotted as a third variable. These diagrams, however, are valid only for the experimental conditions chosen by the investigator, but the trend of the curves remains the same for all conditions, so that the data, modified according to the experiences of the foundries, may be entered into the curves. Further work is being effected with a view to arriving at a more practical use of this method of investigation.

"The Influence of Tensile and Compression Stresses on Graphite and Phosphide Eutectic," by Dr. Ing. Bischof and Prof. Dr. Ing. Max Paschke, of Clausthal. For producing tension and compression stresses in test bars, a simple device has been used—the strain grid—by means of which two bars of 20 millimeters diameter and 150 millimeters long are pressed and pulled alternately into a molding flask. A third bar, cast simultaneously, is kept free from internal stresses.

Preliminary tests indicated that the amount of graphite formed will not be changed by tension or compression stresses, and that with a phosphorus content of about 0.3 per cent, the graphite formed in the compression bar is finer, whereas it is coarser in the tension bar. With a higher phosphorus content of about 1 per cent, the reverse is true. Heats with phosphorus contents of 0.26 per cent to 1.73 per cent confirmed the results of the preliminary experiments. The condition of the graphite in the bar kept free from stresses is intermediate between that of the tension and compression bar. With medium phosphorus content of 0.57 per cent, the condition of the graphite is almost the same in the three bars.

Consider Cast Iron Development

Generally speaking, with the prevailing cooling rates, the phosphide eutectic and the matrix respectively are finest in the compression bars and coarsest in the tension bars.

"Recent Developments in the Manufacture of Heat-Resisting Cast Iron in France," by A. Le Thomas, Saulnes, France. This was the French exchange paper. In heating cast iron to temperatures between 600 and 1000 degrees Cent., the castings undergo changes, which act partly in the same and partly in opposite directions. These phenomena, such as cracks, growth, etc., and their causes, are discussed, and a mechanical device is described which enables these phenomena the better to be understood. The Chevenard dilatometer also has been used to interpret the graphitization and its effects.

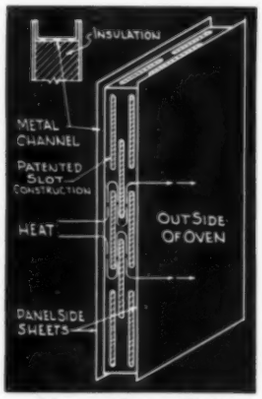
For minimizing corrosion and all other causes of growth, relatively high amounts of silicon, aluminum or chromium are added to the cast iron, these elements forming either an adherent surface layer or producing a dense and largely unattacked structure. In addition, cast iron may be given a high resistance to corrosion at elevated temperatures by hardening it, thus produc-

(*Concluded on page* 88)

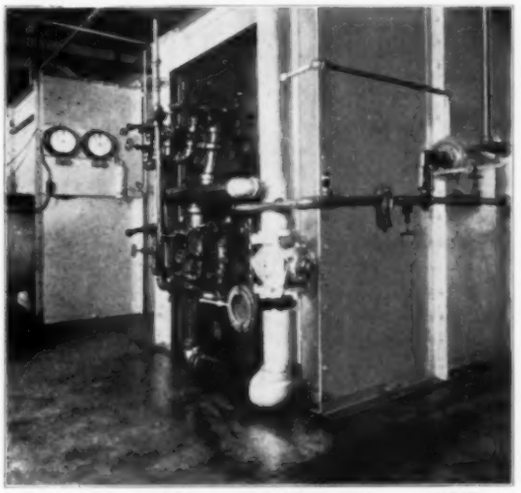
BETTER RESULTS

(The Carl-Mayer Way)

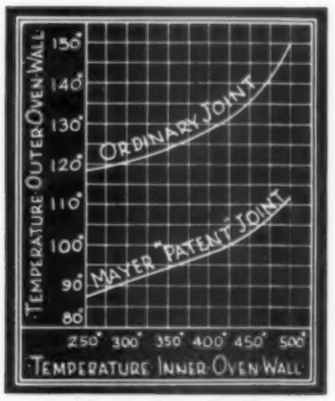
IN CORE AND MOLD OVEN OPERATION



Mayer Oven Wall Construction
Patent No. 1843430

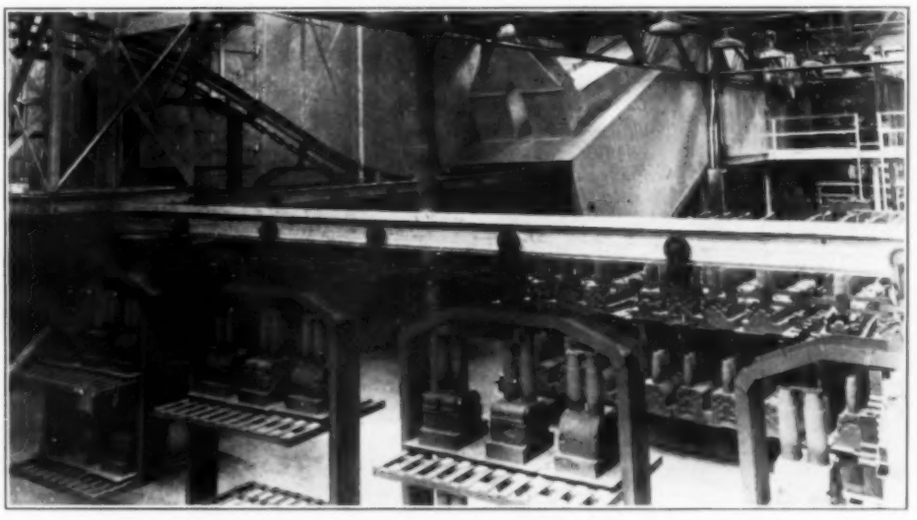


(Gas) Mayer Air Heater. (Oil)
At Packard and American Radiator Co.



Mayer Oven Wall Efficiency 30% Greater

WITH MAYER OVENS



AND AIR HEATERS

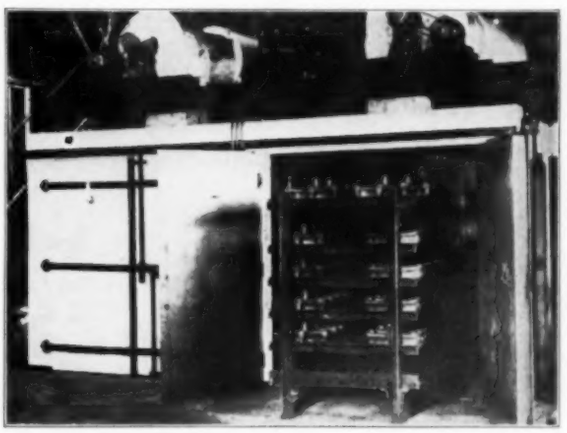
New Continuous Monorail Barrel and Crankcase Core Oven At The Packard Motor Car Company
(One of Seven New Units by Carl-Mayer)

INTERESTING FACTS

About The Packard Installation:

1. **Efficiency 30% greater than desired guarantee.**
2. **Core baking time reduced proportionately.**

These results attributed to "Mayer" patented Oven Wall and Air Heater design.



Rack Type Gas Fired, Air Heater, Core Ovens at Electric Autolite Co.

COMPARATIVE DATA:

Referring to The Electric Autolite installation:

1. **Former baking time in brick core ovens 4½ hours. Baking time in Carl-Mayer ovens 2½ hours for largest cores and 1½ hours for smaller cores.**
2. **Savings per day for each battery of two ovens $21.00.**

Result! *Three* repeat orders this year.

Write for New Literature to

3031 Euclid Ave. THE CARL-MAYER CORP. Cleveland, O.

(*Concluded from page 86*)
ing a considerable amount of cementite; or an austenitic cast iron is resorted to, which contains as alloying elements nickel, manganese and copper, besides chromium.

"Studies of Casting Stresses in Chilled Iron Rolls," by J. Erler, chief metallurgist, Farrel-Birmingham Co., Inc., Ansonia, Conn. This was the official exchange paper presented by the American Foundrymen's association. When using chilled iron castings, three major stresses determine the limits of its usefulness: (1) Stresses set up by the applied load; (2) stresses set up by temperature variance within various sections of the roll; (3) stresses formed in the casting process. Sach's method and modified formula are means to study stresses of chilled iron rolls without any great difficulty if such stresses do not exceed ¼ of the ultimate.

If the relative modulus of elasticity does not exceed one-fourth of the ultimate, it will increase from the center of the roll to nearly double on the chilled zone. Tension and compression have the same relative modulus within those limits. If the relative modulus of elasticity does not exceed one-fourth of the ultimate strength, the Poisson ratio—one-third—can be calculated.

Chill Increases Stress

The stresses are compressive in the surface and tensional within the roll when the rolls are stripped at a very low temperature. The rate of solidification of the metal in the necks indicates an effect on the magnitude of the stress within the roll. Deeper chill will increase the tangential stress on the outer zone and the radial stress in the center.

Sixteen other papers were presented at the meetings, but the printed text was not available at the time of writing: They included the following official exchange papers:

From the Institute of British Foundrymen: "The Structure of Cast Iron," by J. G. Pearce, director of the British Cast Iron Research association; from the Italian foundrymen: "Corrosion-Resisting High-Silicon Alloys," by Dr. Raoul Dupuis, of Fonderia Milanese di Acciaio Vanzetti; from the Czech foundry association "Influence of the Degree of Pressure of Molding Materials on Their Properties," by Prof. Dr. Fr. Pisek and Ing. Homann, Technical High School, Brno; from the Belgian foundry association: "Contribution to the Standardization of Testing Molding Sands," by Fr. Broussard, of Liege.

Cyril A. Fox, Oliver building, Pittsburgh, manufacturer of grinders, has changed the firm name to Fox Grinders Inc.

Discuss Furnaces At Birmingham

The Birmingham Chapter of the American Foundrymen's association met at the Thomas Jefferson hotel, Birmingham, Ala., Oct. 16 for a dinner and evening's program. D. J. Reese, manager, foundry equipment division, Whiting Corp., Harvey, Ill., presented an interesting and instructive talk on "Foundry Melting Furnaces." J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, presided.

In discussing cupola construction, Mr. Reese pointed out the fact that cupola operators have made numerous changes in the tuyeres in an effort to get better melting conditions and higher efficiency. He stated that thoroughly trained supervision would accomplish much more than any such change. Considerable study is required, the speaker stated, to adapt a means for removing slag with a skimmer as the metal leaves the tap hole to individual conditions and practices.

Mr. Reese contended that among the more important things to watch in cupola operation were proper sizing of the coke and metal charges according to cupola size, the smaller cupola requiring, he stated, smaller size raw material than the larger one. He spoke of balancing the bed height and blast pressure to secure a hot melt without undue oxidation of the metal.

Among other subjects, Mr. Reese discussed the air furnace, linings, charging methods, melting rates, fuels, the Brackelsberg furnace, and efficiency of various units in melting iron.

Book Review

Handbook of Engineering Fundamentals, O. W. Eshbach, Editor-in-Chief, and 40 contributors, flexible binding, 1081 pages, 6 x 9, illustrated, published by John Wiley & Sons, Inc., New York, and supplied by THE FOUNDRY, Cleveland, for $5.00 plus 15 cents postage and in Europe by the Penton Publishing Co. Ltd., London.

This is the first volume in the proposed new Wiley Engineering Handbook Series which represents a revision of the basic conception of American handbooks. Since mathematics, physics and chemistry form the basis of all engineering, these are the fields dealt with in the new volume.

The first section presents a selection of mathematical and physical tables, including new and revised tables of the American handbook series. In addition to well arranged tables on engineering constants, properties of numbers, logarithms, trigonometric and hyperbolic functions, there is included a series of tables of conversion factors for weights and measures arranged in order of dimensional sequence, tables of integrals, standard structural shapes, and physical properties of metallic and non-metallic materials.

Other sections offer such features as: the presentation of dimension systems, systems of units, standards, and introduction to the theory of dimensional analysis; the systematically arranged and clearly illustrated fundamentals of theoretical mechanics and mechanics of materials with applications to beams, columns, shafts, and reinforced concrete; the modern theory of fluid mechanics as applied to the fields of hydraulics and aerodynamics; engineering thermodynamics, embodying the latest physical concepts of the fundamentals of heat engineering; the theory of the electric, magnetic and dielectric circuits and their application to generalized networks and transient theory; the fundamental principles of general chemistry, chemical tables and industrial chemistry; the principles of light, acoustics and meteorological phenomena; an extensive handbook treatment of the properties of metallic and nonmetallic materials with reference to features of manufacture and use; and a discussion of the elementary legal aspects of contractual relations with which all engineers should be familiar.

Section 11 devoted to metallic materials gives the general properties of metals and alloys under authorship of Bradley Stoughton, Frank N. Speller, William Corse, J. D. Edwards, Zay Jeffries and other outstanding authorities. Those properties designated for various cast ferrous and nonferrous metals which have been given in low range in older handbooks have been brought up to date to include the properties of modern castings as engineering materials.

Publish Standards

The National Electrical Manufacturers association, New York, recently has published the *NEMA Electric Arc-Welding Machine Standards*. It is a reference work of practical information concerning the manufacture, test and performance of direct and alternating current, arc welding machines.

The welding standards publication also will aid to clear up many troublesome problems for the buyer of arc-welding equipment, and defines numerous terms which have hitherto been subject to various interpretations. Copies of the reference which is publication No. 36-37 may be obtained from the association for 50 cents.

ADVERTISING PAGES REMOVED

Making Bath Tubs On Machines

Conditions differ to a considerable extent between a shop where only one or two men work on bath tubs, and a large specialty shop where the same castings are turned out on an intensive production basis. At present nearly all bath tub castings made in United States foundries are produced under elaborate mechanical equipment including sandslinger machines and jar ramming machines. Under former conditions where the work largely was done by hand and paid on a piece rate basis, one molder and one helper made from four to six castings per day, depending on the size.

In a typical modern plant a 1-ton air hoist suspended from a monorail over each floor is employed for handling flasks and patterns. Cast iron or steel flasks are employed. They are strong and rigid and do not warp, characteristics essential to the production of that class of castings. Flasks for the smaller sizes are made up of a one piece drag and a one piece cope. Flasks for the larger sizes are made up of three parts, a drag, a cheek and a cope. Each section is made up of four parts, two sides and two ends bolted at the corners. In the event of an accident a broken part may be replaced instead of scrapping the entire flask part. By inserting distance pieces between the ends and sides the flasks may be extended to accommodate odd sizes.

An arbor designed to support the comparatively large body of sand forming the interior of the tub is bolted to the drag in some instances, and in others forms an integral part of the flask. The flask joints are planed. The guide pins and holes are machined accurately and at frequent intervals are tested and adjusted to compensate for wear.

In making the mold the pattern is lowered into a suitable follow board which supports it while the drag is being rammed. The follow board is provided with guides corresponding to those on the flask and thus the drag flask is located in its proper relative position so that an even thickness of sand is maintained between the pattern and the walls of the flask. Formerly all flasks were provided with numerous vent holes, but with a fairly open grade of sand it was found that they were not necessary and therefore have been omitted from later flasks. The manner in which the sand is rammed, also the grade of sand employed constitute two of the most important factors in the production of bath tub castings. The vent wire is not used to any extent.

New sand containing a little flour is riddled over the bottom face of the pattern. It is claimed that this precaution prevents the sand from cutting under the iron which is poured in through four wedge shaped finger gates on the top. Thus the iron flows over the mound of sand until the mold is filled. The remainder of the pattern and the drag flask are filled with sand and tramped off in courses. The butt rammer is employed at two stages, once above the sand that will form the joint and again just before the surplus sand is scraped off to form a place for the bottom board.

Just before the bottom board is bedded on the drag a channel is scraped in the sand and the vent wire is employed to form a row of vent holes around the inner wall of the pattern. After the drag and follow board have been rolled over and placed upon a relatively level bed the follow board is removed and set down in readiness for the next mold. After the sixth drag for each team of molder and helper is rammed and rolled over the follow board is put away for the day.

The cheek flask is provided with a number of short chuck bars, spaced a considerable distance apart and with the end far enough away from the pattern to allow the molder to ram continuously around the pattern instead of having to lift his rammer in and out of a number of pockets. The chuck bars extend only about half way up the sides of the cheek and therefore do not interfere in any way with the ramming above that point. Where a cope is employed it merely takes the place of an upset or frame extension to the cheek. No parting is made between the cheek and cope and both cheek and cope are lifted from the pattern as a unit. The cope is not barred. After it is rammed full of sand, a flat plate provided with openings for the gates, is bedded down and clamped to the top flange of the cope. Dovetails for the tub legs are formed by suitable tin devices set in place over straight lugs provided on the pattern for that purpose.

Prepare Transverse Test Bars

Procedure and results obtained in an investigation to provide an improved method for preparing cast iron transverse test bars, are described in Research Paper No. RP880 issued by the bureau of standards, Washington. The investigation was conducted by A. I. Krynitsky and C. M. Saeger Jr. Copies may be obtained from the Superintendent of Documents, Washington, for 5 cents.

Philadelphia Group Visits Plant

Bethlehem Steel Co. played host to the members of the Metropolitan Philadelphia Chapter of the American Foundrymen's association on Oct. 9 at Bethlehem, Pa. Starting early in the afternoon, a tour was conducted by the company through its coke and by-product plant, sintering plant, ore storage, blast furnaces, foundry, machine shops and power plants. P. E. McKinney, metallurgical engineer at the Bethlehem company, was in charge of arrangements which included a dinner at the Hotel Bethlehem and a talk on "Raw Materials for the Iron and Steel Industry," by W. S. Bourlier, chief engineer of the Bethlehem mines department.

Quad-City Chapter Meets In Iowa

L. B. Knight Jr., vice president, National Engineering Co., Chicago, delivered the principal address of the evening at the regular meeting of the Quad-City Chapter of the American Foundrymen's association, held Oct. 19 at the Blackhawk hotel, Davenport, Iowa. Speaking before approximately 80 men, Mr. Knight devoted his remarks to a discussion of "Foundry Sands: Their Reclamation, Conditioning and Control."

Various types of sand used for different castings, with properties recommended to have given satisfactory results, were considered by the speaker. He talked on the handling of sand in both large and small production foundries, and told how sand may be reclaimed and used with good results, providing consideration is given to its proper conditioning and control. Mr. Knight also gave interesting data compiled from various tests made in several foundries throughout the country.

Gives Discussion on Superheating

Engineering Experiment Station, Michigan State college, East Lansing, Mich., has published a 36-page bulletin entitled, "Symposium on High Temperature Melting of Cast Iron," which contains all the discussion evoked at a sectional meeting of the American Foundrymen's association held in East Lansing during the early part of the year. Material contained in the bulletin was compiled by F. G. Sefing and M. F. Surls. Copies may be obtained from the experiment station for 25 cents.

Obituary

J H. KELLY, 62, superintendent of the Ironton, O. plant, Dayton Malleable Iron Co., died Oct. 19. Mr. Kelly was born in Batavia, N. Y. and entered the employ of the Johnston Harvester Co. at the age of 16. Starting in the core department, he was advanced to the foundry where he learned the molding trade. In 1907 he was made superintendent of the Johnston Harvester Malleable foundry and remained in that position until 1913 when he went to Danville, Ill. and helped establish and operate as superintendent, the Danville Malleable Iron Co. Mr. Kelly joined the Dayton Malleable Iron Co., as superintendent of the Ironton plant in 1919, and retained that title until his death.

♦ ♦ ♦

Frederick H. Leuders, sales representative, Seybold division, Harris-Seybold-Potter Co., Dayton, O., died in Dayton Sept. 23.

♦ ♦ ♦

Theodore Kupfer Sr., 75, founder and president of the Kupfer Foundry & Iron Works Inc., Madison, Wis., died recently. Mr. Kupfer established his firm in 1891.

♦ ♦ ♦

George M. Wall, 66, former vice president and general manager of the Sheldon Axle & Spring Co. and a director of the Vulcan Iron Works, both of Wilkes-Barre, Pa., died Oct. 13 in Wilkes-Barre.

♦ ♦ ♦

Charles G. Jurack Sr., 78, founder and president of the Charles Jurack Co., Milwaukee, pioneer manufacturer of wood and metal patterns for the foundry trade, died in Milwaukee Oct. 23.

♦ ♦ ♦

James T. Skelly, 59, vice president and director, Hercules Powder Co., Wilmington, Del., died in Wilmington, Oct. 31. Mr. Skelly had served the explosives-consuming industries for 44 years.

♦ ♦ ♦

Parker Sloane, 64, long interested in the manufacture of iron alloys, died in New York Oct. 3. Mr. Sloane built a large electrometallurgical plant at Niagara Falls, N. Y., which was later absorbed by the Vanadium Corp. of America.

♦ ♦ ♦

Seth A. Crone, 77, founder and president of the Buffalo Brake Beam Co., New York, died in Montclair, N. J., Oct. 16. He was president of the Acme Steel & Malleable Iron Co., Buffalo, and a director of Dominion Foundries & Steel Ltd., Hamilton, Ont.

♦ ♦ ♦

James B. Patterson, 45, vice president of the Hopp-Patterson Co., Chicago, died, Oct. 15 following an operation for appendicitis. A graduate of the Carnegie Institute of Technology, Mr. Patterson for many years was Chicago representative for the P. H. & F. M. Roots Co. Later he joined J. H. Hopp in organizing the Hopp-Patterson Co. to sell machinery and materials as well as to serve as engineers and consultants to the metalworking industry.

♦ ♦ ♦

William Wahl, 74, for many years an employe of the National Malleable & Steel Castings Co., Cleveland, died Oct. 13 in Cleveland. The day before his death he had completed 60 years service with the company. Mr. Wahl was born in Waldorf-Baden, Germany, and came to Cleveland when he was 9 years old. At 14 he entered the core making department of the company and eventually became foreman, a position which he held for many years. Recently he had been employed in the laboratory.

Arrange Old Casting For Pattern

By Frank G. White

Occasionaly every foundry receives an emergency order for one or a few castings. The order is accompanied by a broken casting to be used as a pattern. This service has to be rendered to a customer even though it usually causes a loss to the foundry.

The method of mounting the pattern, shown in the accompanying illustration, eliminates most of the work in the foundry, or the need of any molding skill on the part of the operator.

An ordinary hand wheel will serve for an example. The patternmaker drives a wood plug into the center hole and trims it flush with both faces of the hub. A ¾-inch piece of stock *A*, Fig. 1, 2½-inches larger than the diameter of the wheel is fastened with a screw in a center. A course of segments *B* of a thickness to coincide with the parting line is placed around the casting and fastened to the board *A*. One inch from the outside of the casting a circle is struck from the center of the hub. The band saw table is set to give the proper draft and the segments *B* are sawed and then sandpapered to line. A flat place is cut at one side to make a match. The blocks *C* then are cut and dropped between the arms of the wheel up to the parting line. The gate is built around the print into the casting opposite the flat on the print. The pattern then is ready. Later in the foundry it is dusted with a parting powder to prevent the sand from sticking.

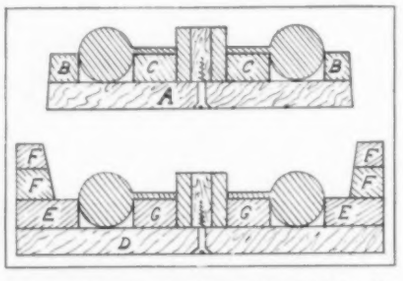


Fig 1 (Above)—Pattern attached to the follow board. Fog. 2 (Below)—Pattern mounted temporarily in cover corebox

After the pattern layout has been prepared, the casting is removed, reversed and fastened temporarily to the board *D*, Fig. 2, for a corebox. A course of segments *E* is built up to the parting line, and two more courses *F* and *G* are added to form the outside of the core print. One, or any required number of cores are made in this corebox. Then the casting is removed and replaced on the first board as shown in Fig. 1. This now is a flat back pattern that can be molded in any flask, either alone or with other patterns at no expense for molding. The entire preparatory labor should not exceed 1 hour for the patternmaker and ¼-hour for—say—six cover cores.

Trade Practices Are Studied

A study of American trade practices, dealing with the timely acquirement of trade mark and patent rights and vigorous repression of all forms of unfair competition, has been made available by the bureau of foreign and domestic commerce, Washington. Entitled "Industrial Property Protection Throughout the World," the study has been prepared by James L. Brown, division of commercial laws, and is designed to acquaint the American manufacturer and trader with those industrial property matters which experience has proved to be necessary, in the protection of established and potential market for their goods.

Hot Galvanizing

A compilation of scattered references on the subject of hot galvanizing available in the technology department of the Carnegie Library of Pittsburgh, covering a period from 1910 to the present recently has been published by that institution. The bibliography, which is in mimeograph form, was prepared by Victor S. Polansky, and covers 110 pages. The work is divided into 14 sections relating to general and miscellaneous; history and development; procedure; equipment and fuels; effects; tests; corrosion and corrosion resistance; products; welding; specifications etc.

Dust Analysis by Quick Observation

• • • not by the time-consuming method of air-sampling

Leitz

The Leitz TYNDALLOMETER speeds up and simplifies determination of the dust content of rooms. It is in effect a portable photometer by which measurements are made of the so-called Tyndal light. No air sampling, of course, is necessary. Nor does the instrument require a skilled technician in order to obtain accurate figures.

Every foundry faced with a dust-laden air problem should have in its instrument room one of these TYNDALLOMETERS. It would serve as a measure of both assurance and protection.

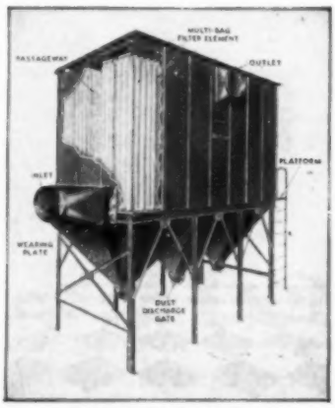
E. LEITZ, Inc.

60 E. 10th St., New York, N. Y.
Washington Chicago Detroit

Western Agents: Spindler and Sauppe, Inc., Los Angeles — San Francisco

1937 Will be a BETTER YEAR for those with DUST CONTROL

Get DRACCO Bulletin No. 301



THE NEW DRACCO MULTI-BAG FILTER

INTENSIVE competition makes it imperative to produce castings at the lowest possible cost. If there is Dust in your Foundry you have an enemy that always adds to your production cost; it never contributes to lower cost. It takes its toll in four distinct ways: (1) impairs health of workers, (2) destroys equipment and increases repairs, (3) reduces plant efficiency, (4) is the cause of expensive and annoying law suits. 1937 will be a better year for those using DRACCO Dust Control to make their Foundries a healthier and safer place in which to work. Let DRACCO Engineers study your problem and recommend the proper solution.

DRACCO CORPORATION
Successors to The Dust Recovering & Conveying Co.
4050 E. 116th St. Cleveland, Ohio

WRITE FOR BULLETIN NO. 301

GLOBE SHOT

H.C. CHILLED GLOBE SHOT
Reg. U. S. Pat. Off.

Cuts Cleaning Costs!

Every saving counts now when costs must be cut to meet conditions. Why let the other fellow with lower cleaning costs have the advantage over you in figuring selling prices?

One ton of Globe shot in most cases will convince you that shot-blasting is the low-cost way to clean castings, whether grey iron, malleable or steel.

Write us for samples and data that *shows* you why Globe Shot will save you money.

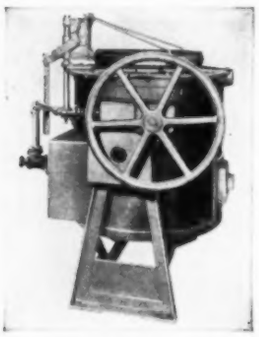
CORRECTED STEEL GLOBE GRIT
Reg. U. S. Pat. Off.

The GLOBE STEEL ABRASIVE CO.
Dept. F
Mansfield, Ohio

NEW EQUIPMENT . . . . *for foundries*

Melting Furnace of Crucible Type

Philadelphia Drying Machinery Co., Philadelphia, recently has introduced a new line of crucible melting furnaces. The furnace casing is constructed of heavy rolled steel plate, reinforced and electrically welded. The lining and cover tile are made from a special mixture of silicon carbide.



The tilling hand wheel turns in the same direction as the furnace

To facilitate draining the metal in case of crucible failure, an opening is provided in front of the casing on a level with the bottom of the furnace. Heavy cast iron trunnions attached to the casing support the furnace so that it is balanced and tilting can be accomplished with little effort. The tilting handwheel turns in a direction parallel to the motion of the furnace and is geared to a worm gear which is self-locking so that the furnace can be left in any desired position. Pull type furnaces are of the same construction and arrangements as the tilting type, with the exception of the trunnions, steel frame and tilting mechanism.

Roll Crusher

Jeffrey Mfg. Co., Columbus, O., has developed a newly-designed double roll crusher. Chief feature of this machine is a self-contained endless belt drive between the rolls which allows quick adjustment of the rolls within the limits of the sizing range while the machine is running. The crusher is provided also with an all-steel frame having heavy steel cross-ties.

Outside Temperature Governs System

Link-Belt Co., Chicago, has developed a heating system with radiostat control, designed for low-pressure jobs in buildings above a certain size. It is pointed out that a saving of 15 per cent and more in the use of steam above the boiler room, in addition to an average saving of 42 per cent in steam production costs, is a feature of the unit.

With radiostat control, the outside temperature is the governing factor, its electronic tubes being sensitive to a change of as little as 1 degree. Parts going into this heating system include a master control, a boiler submerged just below water level, heat sensitive element placed on the outside north wall and a return line element coming from the most desirable part of the building for temperature control.

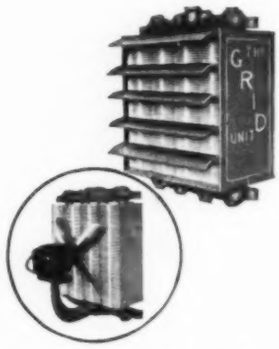
Controller Embodies New Principles

Bristol Co., Bristol, Conn., has made available a new series of pneumatic type recorder controllers for controlling automatically temperature, time-temperature, flow, liquid level, pressure, time-pressure and humidity. A recently developed system of telemetering for the remote control of steam and gas pressure has been combined in the units.

Certain features of field adjustability have been added to the system whereby its sensitivity can be changed by a small screw driver to fit the peculiarities of the process on which it is used. This operation can be accomplished without removing the chart or chart dial. By the same adjustment, the instrument can be changed from direct-acting to reverse-acting or vice versa.

Develops Four New Unit Heaters

Unit Heater & Cooler Co., Wausau, Wis., has placed four new sizes of its unit heater on the market. As shown in the accompanying illustration, the heater has all-cast aluminum heating sections bound with the steam chamber. The new models at 2 pounds steam pressure and 60 degrees Fahr. temperature have the following capacities: 56,750 B.t.u. with 1290 cubic feet per minute air volume at the fan; 97,500 B.t.u. with 2500 cubic feet per minute air volume at the fan; 158,500 B.t.u. with 4200 cubic feet per minute air volume at the fan; and 248,000 B.t.u. with 5300 cubic feet per minute air volume at the fan.



All-cast aluminum heating sections eliminate corrosion

Pillow Block Has Steel Housing

Palmer-Bee Co., Detroit, has developed a self-aligning pillow block to simplify the alignment of shafts and to take care of light or heavy shock loads at either high or low speeds. Housing construction is of cast steel, machine finished to a spherical surface and fit that permits a free oscillating movement of about three degrees maximum in any direction. It is said to be dust and dirt-proof. The pillow block is mounted with a heavy duty precision bearing.

ADVERTISING PAGES REMOVED

Induction Motor Has High Torque

A new single phase, repulsion-start induction motor has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., specially designed for heavy industrial duty. The unit has high starting and pull-in torques, said to make it particularly suitable for such applications as pumps, compressors, etc. It is available in a complete line of ratings. ¾ to 3 horsepower, 110/220 volts dual voltage for operation on all commercial frequencies.

The motor starts as a repulsion type and, because of the high torque developed, comes up to speed in a short time. At approximately 60 per cent of synchronous speed, the armature is short circuited by a centrifugally operated device and the motor continues to operate as a squirrel cage induction motor.

Regulator Designed For Low Capacity

DeVilbiss Co., Toledo. O., has designed a new low capacity regulator for the sensitive regulation of air pressures below 30 pounds. Sensitivity is in the unit due to a 4-inch diameter diaphram. Regulated air pressure can be graduated up to 30 pounds with only one ounce variation for each 10 pounds' variation of main line pressure.

The diaphram is clamped in the regulator body between two brass castings fastened together by radially spaced bolts. Special valve design and construction prevent the valve seat from cutting into the rubber valve.

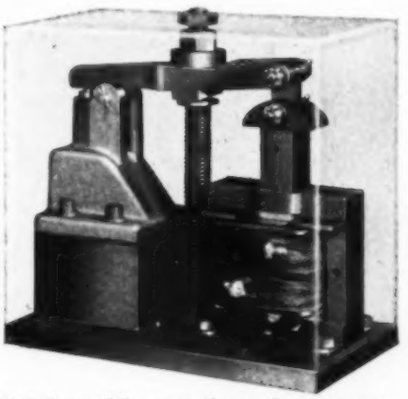
Workshop Lathe Has Motor Drive

The pedestal type motor drive has been incorporated in the new 9-inch workshop lathe recently developed by the South Bend Lathe Works, South Bend, Ind. This motor drive mechanism is a separate unit mounted on a metal pedestal back of the lathe with the horizontal countershaft and motor supported at the top of the pedestal in line with the headstock cone pulley.

An adjustable tension brace between the countershaft and the headstock regulates the tension of both the flat belt between the cone pulleys and the V-belt from motor to drive pulley. A belt tension release lever attached to the tension brace permits easy shifting of the cone pulley belt from one step of the pulley to another. When the lever is pulled toward the operator, the motor drive is tilted forward on its pivoting frame sufficiently to shift the spindle belt. The lathe has a three cone headstock providing six spindle speeds, the bed is a one-piece casting of steel and nickel iron and the headstock casting is reinforced and webbed.

Solenoid Air Valve Used As By-pass

Ross Operating Valve Co., Detroit, has introduced a new solenoid controlled straightway air valve. The unit is designed particularly for use as a by-pass, tying in with



Unit is used in operations where pressure in cylinder must be controlled

other operations where pressure in a cylinder must be regulated, and for various production plant services.

The valve may be used in the maintenance of constant fluid levels in tanks in connection with floats, remote control of air whistles and in welding machine operation where it is desired to move the piston in the air cylinder at a slow rate of speed through low pressure.

Compensator Unit Is Pressure Tube

The Foxboro Co., Foxboro, Mass., has designed an automatic pressure compensator for its line of flow meters, to prevent errors in the flow reading directly influenced by variations in the static pressure of the flow. The unit is a simple spiral pressure tube connected to a lever.

As the line pressure changes, the spiral adjusts the multiplication of the linkage between the float and pen arm in a percentage correction. The linear amount of correction differs at different points of the chart and is calibrated to fit the flow formula of the meter.

George P. Reintjes Co., Kansas City, Mo., has appointed the Moorlane Co., Tulsa, Okla., as a sales representative for the company's line of furnace walls and arches.

Makes Slip Jacket And Board

A material which it is claimed is not affected by heat or moisture and therefore adapted for the manufacture of slip jackets and bottom boards, recently has been developed by the Norristown Magnesia and Asbestos Co., Norristown, Pa. The material may be applied to new bottom boards, or to those already in use, but which no longer present a firm uniform surface. The company now is in position to supply bottom boards in standard sizes with this material attached to the face. It is claimed that the cost does not greatly exceed the cost of making new boards. Slip jackets of the same material are available in all standard sizes. The idea was conceived and experimental work conducted by the plant manager of a large eastern malleable iron corporation where the equipment has been adopted as standard.

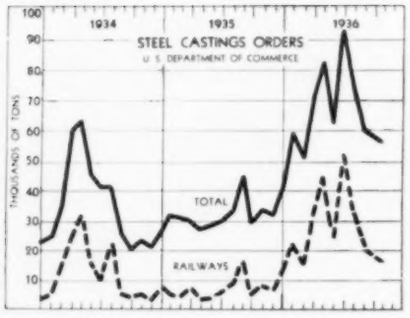
Double Compressor Is Steam Driven

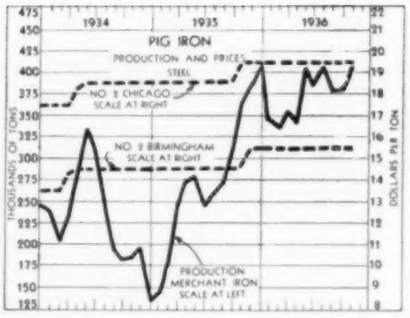
A new single stage, steam driven, horizontal compressor has been placed on the market by the Sullivan Machinery Co., Michigan City, Ind. Used for steam pressures from 80 to 250 pounds, air pressures up to 150 pounds and available in sizes from 279 to 1987 cubic feet per minute, the unit is double acting for either air or gas compression.

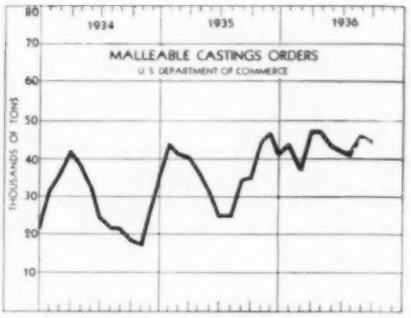
The steam cylinder is placed in tandem with the air cylinder next to the frame and is lagged heavily for steam economy. The steam valve is of the balanced piston type with inlet pressure in the middle so that the valve rod box is sealed against exhaust pressure only. Other features include a throttling fly-ball governor for steady steam and air pressure, a fly wheel governor for variable steam with steady air pressure, a special cast alloy air cylinder liner and valves with laminated cushion backs.

Use Rubber Tire on Aluminum Barrow

Sheet Aluminum Corp., Jackson, Mich., has developed an aluminum wheelbarrow which is said to reduce the weight by 40 pounds. Made in 2½ and 4½ cubic foot sizes, the carrier is equipped with a 4 x 14-inch pneumatic tire. It is claimed that this feature takes the shocks from uneven floors instead of transmitting them to the operator. Pan and structural frame have been made of a high strength nickel aluminum alloy.







Foundry Activities

FOUNDRY operations in the Chicago district increased slightly the latter part of October after being steady during the fore part of the month. Measured by pig iron shipments there was a 10 per cent pickup over September, though part of this gain was accounted for by the increased proportion of pig iron in the melt. High prices have tended to curtail use of scrap. Producers of automotive castings have expanded their schedules in keeping with the upturn in 1937 model assemblies. Tractor builders continued steady operations, while farm implement manufacturers have commenced a seasonal increase in output. Steel foundries have remained busy on railroad equipment work.

* * *

Citizens of Bremen, Ind., are considering building and operating a gray iron foundry.

* * *

Madison Brass Works, Madison, Wis., is planning to build a foundry addition 30 x 70 feet.

* * *

Albion Malleable Iron Co., Albion, Mich., suffered damage to its plant by fire recently to the extent of $1000.

* * *

Wilkening Mfg. Co., Philadelphia, is reported building a foundry for the manufacture of piston rings.

* * *

Simonds Saw & Steel Co., Lockport, N. Y., will ask bids soon for construction of a foundry to cost $37,500.

* * *

York Street Brass & Aluminum Foundry, 125 East York street, Baltimore, plans the construction of a 1-story addition to cost $45,000.

* * *

Lake Union Foundry Co., Seattle, recently suffered damage by fire to its plant at 1703 Westlake avenue north, Seattle, amounting to $1500.

* * *

Caterpillar Tractor Co., Peoria, Ill., is increasing the size of its cleaning room and making additions and improvements to other equipment.

* * *

Ozark Foundry Co., St. Louis, has leased the former O'Neil foundry at 3600 South Second street, St. Louis, and has let contracts for improvements and plant alterations.

* * *

Fargo Foundry Co., Fargo, N. Dak., has awarded contract for remodeling its main building. The northeast corner of the plant will be removed to make room for the Center avenue bridge and a second story addition will be built to take its place. A. G. Kinney is manager.

* * *

Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., plans building an addition to its plant, costing over $37,000. Architect is F. A. Weston, Waterbury.

* * *

Worthington Pump & Machinery Corp., Iroquois building, Buffalo, will construct a $60,000 addition to its foundry, to increase production 25 per cent.

* * *

Superior Die Casting Co., Cleveland, has taken a lease on the former Cleveland Automobile Co. four-story building at Euclid avenue and London road northeast.

* * *

Neenah Foundry Co., Neenah, Wis., has let contract to the Flour Construction Co., Oshkosh, Wis., for a plant extension 60 x 80 feet. E. J. Aylward is president.

* * *

Advance Pattern & Foundry Co., Chicago, has been incorporated by N. Shean, E. G. Grundstrom and R. W. Wilson. Correspondent is Sanders, Childs, Bobb & Westcott, 231 South La Salle street, Chicago.

* * *

Riverside Brass Foundry Inc., Elkhart, Ind., has been organized to conduct a foundry for casting brass and other metals. Resident agent is Ruskin B. Phillips, 117 West Marion street, Elkhart.

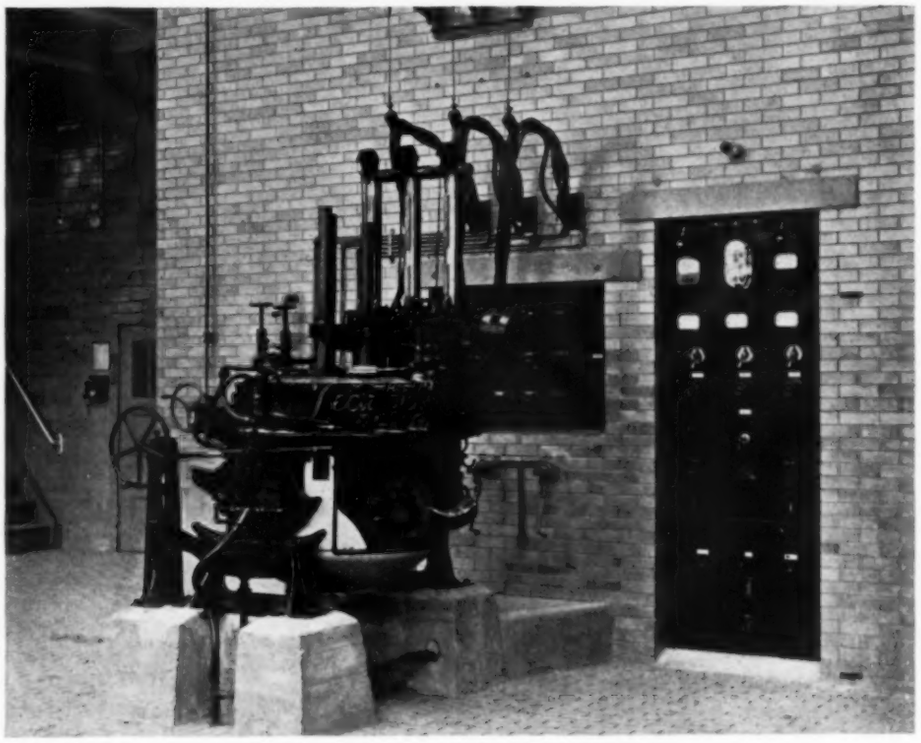
* * *

Index of foundry equipment orders, according to a report of the Foundry Equipment Manufacturers' association, Cleveland, was 161.0 for

(*Concluded on page* 100)

RAW MATERIAL PRICES
Nov. 5, 1936

Iron	
No. 2 foundry, Valley	$19.50
No. 2 Southern Birmingham	15.50
No. 2 foundry, Chicago	19.50
No. 2 foundry, Buffalo	19.50
Basic, Buffalo	18.50
Basic, Valley	19.00
Malleable, Chicago	19.50
Malleable, Buffalo	20.00
Charcoal iron, furnace	22.50
Coke	
Connellsville beehive premium	$5.50
Wise county beehive coke	$ 4.30 to 5.00
Detroit by-product delivered	10.70
Scrap	
Heavy melting steel, Valley	$16.75 to $17.25
Heavy melting steel, Pitts. (dlv.)	17.50 to 18.00
Heavy melting steel, Chicago	16.25 to 16.75
Stove plate, Buffalo	11.50 to 12.00
Stove plate, Chicago	9.00 to 9.50
No. 1 cast, New York	12.00 to 12.50
No. 1 cast, mchy., Chicago	14.00 to 14.50
No. 1 cast, Pittsburgh	15.50 to 16.00
No. 1 cast, Philadelphia	16.50 to 17.00
No. 1 cast, Birmingham	11.50 to 12.50
Car wheels, iron, Pittsburgh	17.50 to 18.00
Car wheels, iron, Chicago	16.50 to 17.00
Railroad malleable, Chicago	18.00 to 18.50
Malleable, Buffalo	17.00 to 18.00
Nonferrous Metals	**Cents per pound**
Castings copper, refinery	9.70
Straits tin	49.37½
Aluminum, 99 per cent	19.00 to 21.00
Aluminum, No. 12 (Secondary, standard)	16.75 to 17.25
Lead, New York	5.00
Antimony, New York	12.50
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	4.85



Installation of one of the smallest size three phase Lectromelts—a 250 pound per hour furnace . . .

This size as well as the larger and smaller sizes in the standard line of Lectromelts are pictured and described in a new catalogue, Number 1136, just issued . . . copy on request.

PITTSBURGH LECTROMELT FURNACE CORP.
Foot of 32nd Street, Pittsburgh, Pa.
ELECTRIC MELTING, REFINING AND SMELTING FURNACES—STANDARD SIZES 25 POUNDS TO 50 TONS

The Moulder knows—

"Cambridge"
HINGE TUBES
make better Castings

◆

CAMBRIDGE HINGE TUBE & CHAPLET WORKS INC.
Cambridge, New York
Originators of No. 43-COT Cover Lip
(the improved No. 43)

DEPENDABLE UNIFORMITY

Steelblast Shot and Grit are always uniform for size, quality, and temper. Accurate sizing insures adaptability to your class of work and uniform finish. Quality and Temper insure long wear, fast cutting and slow disintegration. Steelblast Abrasives Company, 6538 Carnegie Avenue, Cleveland, Ohio.

STEELBLAST ABRASIVES

(*Concluded from page 98*)

September, 1936, as compared with 144.8 in August, 1936, and 128.4 for September last year. Index of shipments was 150.5 in September this year, 137.2 in August and 124.7 in September, 1935.

* * *

W. H. and H. Don Forse have purchased the Lavelle Foundry plant in Anderson, Ind., and may remodel it for manufacturing window shades, venetian blinds or dry cleaning equipment.

* * *

Industrial Pattern Works, Detroit, has changed its name to the Industrial Pattern & Engineering Co. Management includes R. M. Scott, president, A. Wolley, secretary and treasurer, and E. F. Wade, general manager.

* * *

Valley Bronze & Machine Works, Webster City, Iowa, formerly of Valley Junction, Iowa, has leased a factory building in Webster City and will install equipment. Howard A. and George Wilhelm are the proprietors.

* * *

T. L. Artz Foundry Co., Springfield, Ill., has been incorporated by T. L. Artz, Leo S. Sikunski and Joseph M. Artz, to carry on a general foundry and machine shop business. Correspondent is P. F. Murray, 716 Ashland block, Springfield.

* * *

Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., has leased ground on the Michigan Central railroad north of McKinley street in Lansing, Mich., and will erect a new foundry on the property. Buildings and melting equipment will be provided by the Motor Wheel Corp., Detroit, owner of the real estate, for whom the Campbell company will operate the plant. The foundry is expected to be in operation early in January. Approximately $1,000,000 will be invested in buildings and equipment.

* * *

Production of gray iron and steel castings in the Philadelphia Federal Reserve district increased during September, according to reports received by the industrial research department of the University of Pennsylvania. A rise of 3.6 per cent in the output of steel castings nearly offset the decline reported last month; the gain of 10.1 per cent in activity of the iron foundries compensated for most of the decrease in July and August. During the last twelve months both groups have recovered rapidly. When reports of this month are compared with those of a year ago, the iron foundries show increases of 61.9 per cent in production, 57.7 per cent in shipments and 34.5 per cent in unfilled orders. Steel foundries show even larger increases: 145.7 per cent in production, 204.5 per cent in shipments and 109.6 per cent in unfilled orders.

New Trade Publications

AIR COMPRESSORS — Worthington Pump & Machinery Corp., Harrison, N. J., has issued a folder on its single, direct-acting, air-cooled air compressor line, giving illustrations, specifications and uses.

TRAVELING CRANES—Whiting Corp., Harvey, Ill., has issued a folder on its low-head type traveling crane for hand or electric power operation. Features of design are discussed and a partial list of users is included.

POWER TRANSMISSION — Link-Belt Co., Chicago, has published a new 208-page catalog devoted exclusively to power transmission equipment, featuring antifriction roller bearing units, streamlined babbitt bearings and takeups.

DUST COLLECTING—A quick reference booklet has been issued by Pangborn Corp., Hagerstown, Md., concerning its line of blast cleaning and dust collecting equipment. Blast rooms, barrels, tables, cabinets and accessories are featured.

EXHAUST FANS — Northern Blower Co., Cleveland, has prepared a bulletin relative to its line of slow speed low power exhaust fans. Manufacturing details concerning the dust collecting and air handling problem are presented in addition to a capacity chart.

GRINDING WHEELS — Norton Co., Worcester, Mass., presents graphically several examples of its line of abrasives employed in tool and cylindrical grinding, snagging, cutting-off and slotting and cemented carbide grinding, in a recent publication.

CENTRIFUGAL CASTING—Shenango-Penn Mold Co., Dover, O., illustrates a trip through the company plant in its latest bulletin. A description of the foundry, the centrifugal casting process employed, machine shop, furnaces and general work are featured.

COMPRESSORS — Worthington Pump & Machinery Corp., Harrison, N. J., has published four bulletins. One concerns the company's line of single tandem horizontal two-stage steam and motor driven compressors. A second describes its single horizontal, three-stage steam and motor driven units. Horizontal single piston pumps for general service for pressures up to 75 pounds per square inch and similar pumps for pressures up to 250 pounds per square inch are described in two other bulletins.

CORE OILS—Certified Core Oil Co., Chicago, has used a distinctive means of presenting its line, in a current booklet. The publication provides a reference book for use when anything goes wrong in the core room.

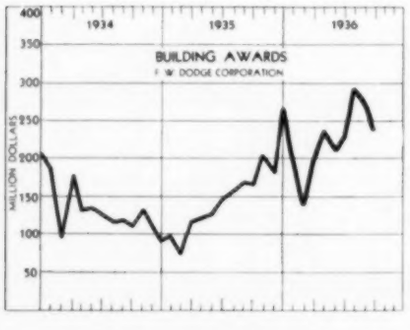
ROTARY GRINDERS — Illustrations and construction details of its line of rotary grinders are given by the Cleveland Pneumatic Tool Co., Cleveland, in an attractive bulletin recently published. Vertical rotary sanders, wheels and brushes for grinders, bench and floor rammers, core breakers, couplings, etc., are also discussed.

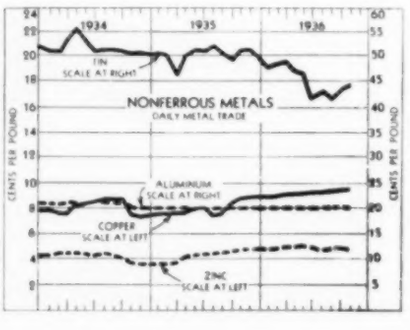
CUPOLA BLOWING — Ingersoll-Rand Co., New York, illustrates and describes its blower with air weight control as a feature of its latest bulletin. How this air weight control works and a description of the construction of the blower is included. Also, an article by H. V. Crawford, on modern theory and practice in cupola blowing is given.

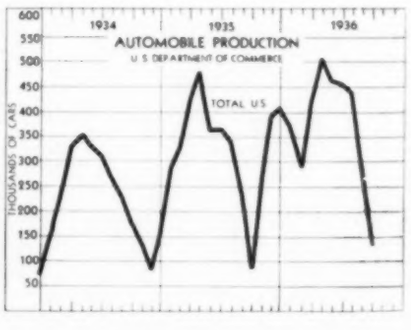
ELECTRIC CONTROL — Leeds & Northrup Co., Philadelphia, discusses its control system for regulating input in proportion to demand in an 8-page catalog. Based on a simple potentiometer balance, this control consists of three integral parts—control instrument, relay detector and valve mechanism.

MOTORS—General Electric Co., Schenectady, N. Y., publishes recent improvements in its line of squirrel-cage polyphase induction motors in current literature. Co-ordination of design permits the different modifications of motors in the line to be used interchangeably. Details of its new insulation system now used in these motors also are included in the publication.

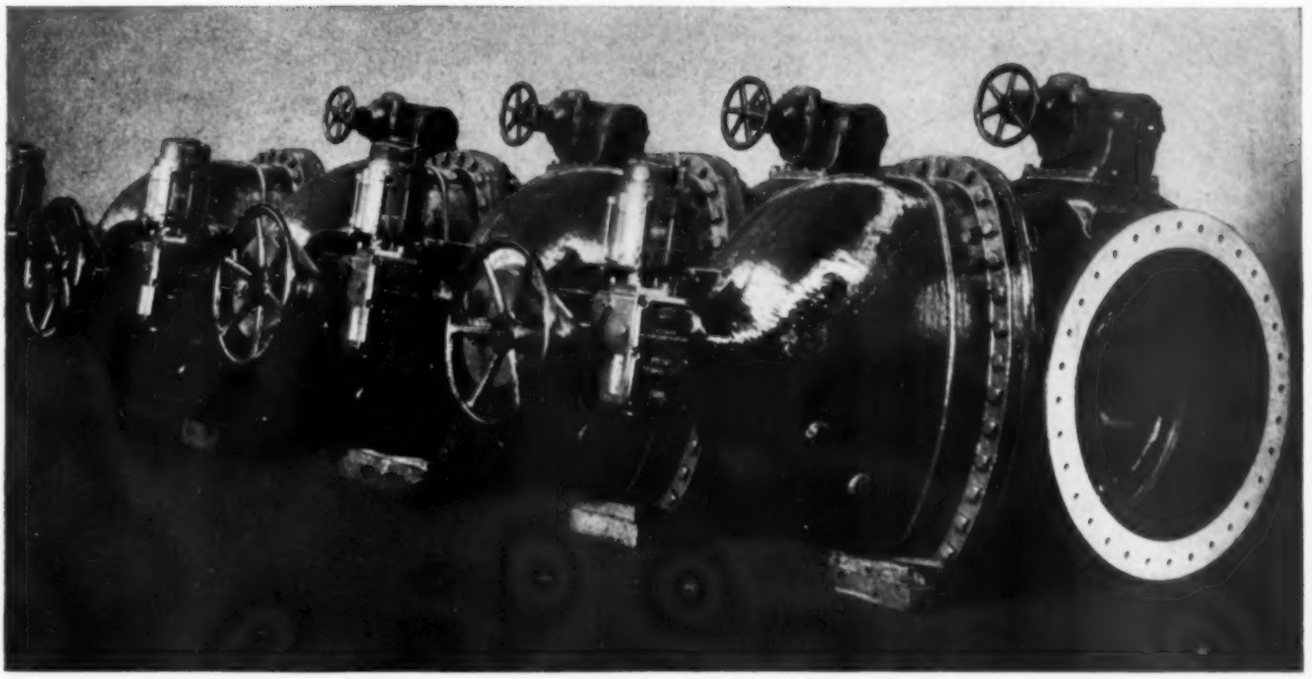
PIG IRON—Sloss-Sheffield Steel & Iron Co., Birmingham, Ala., recently has published a 19-page booklet on the subject of phosphorus in gray iron. It contains three articles and a castings analyses guide. Articles included are "Six Years of Progress in the Metallurgy of Phosphorus in Cast Iron," "Treatise on Phosphorus in Foundry Pig Iron," and "The Carbon Equivalent in Gray Iron control."







Kennedy Valve Mfg. Co. eliminates chills



Assures easy machinability with Silvery Mayari

KENNEDY Valve Mfg. Co., Elmira, N. Y., obtains uniformly excellent results in casting valve parts in a wide range of sizes and for both high and low pressures with Silvery Mayari Alloy Iron. They have found that using Silvery Mayari does away with the need for chills, produces a uniformly dense grain structure throughout and assures easy machinability of both the inside and outside of all castings, on both thick and thin sections. In addition, Silvery Mayari's fine flowing qualities allow a variety of parts to be cast from the same mixture.

Such increased operating efficiency and improved quality are typical of results being obtained with Silvery Mayari in foundries throughout the country.

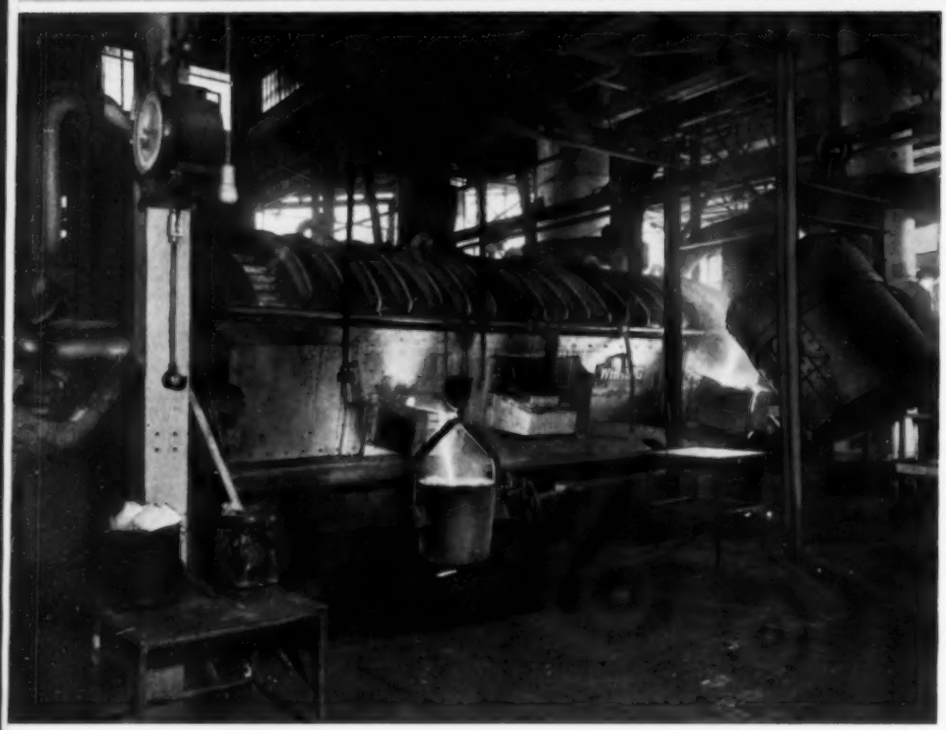
A low-cost, natural alloy iron, Silvery Mayari contains a correct proportion of all the elements essential to the economical production of good, sound, high-strength castings. The fact that these elements are present in the iron itself does much to simplify cupola practice and increase operating economy. Further economy results from Silvery Mayari's 9 to 12 per cent silicon content, which allows a larger proportion of steel scrap to be used, thus reducing pig iron inventories.

If you are interested in lower-cost production of high-quality castings and more consistently profitable operation, you will want to discuss the use of Silvery Mayari with Bethlehem foundry specialists.

BETHLEHEM STEEL COMPANY

BETHLEHEM STEEL

ANOTHER METALLURGICAL ACHIEVEMENT



A 10-ton capacity Cradle Furnace in operation in a large automotive production foundry. Large ladle at right is used to transfer molten metal from Brackelsberg furnaces to the cradle furnace.

Accurate control of chemical analysis and Brinnell hardness

Rapid delivery thru "lip" pouring instead of tapping

A constant supply of superheated metal (from top of bath) for conveyor lines

Low-cost operation (fuel-fired)

All these outstanding advantages are brought to the producers of high-quality castings and production foundries by the use of the

New "Cradle" Furnace

Developed to serve as a "balance" wheel in a continuous pouring foundry, its utility was quickly recognized and proved. Besides the one that has been in operation for some time, two furnaces are now under construction for use in a gray iron duplexing system, and a fourth furnace has just been ordered by a large malleable foundry.

Fired with pulverized coal (or other fuels), the "cradle" furnace serves as a large reservoir or mixer for hot metal from cupola, air furnace, Brackelsberg furnace or electric furnace. It is designed to tilt or rock "cradle-wise" by power; and can receive metal while filling ladles. Arranged for lip pouring, it eliminates expensive and troublesome tap-hole blocks. Faster pouring means less temperature drop to the ladle.

If interested, a Whiting engineer will gladly discuss the possibilities of the "cradle" furnace in your foundry, on request.

Same furnace as shown above, tilted to skimming position. Furnace may be tilted 22 degrees in either direction. This installation uses a Whiting No. 15 pulverizer and burner (pulverized coal fired).

WHITING CORPORATION
15607 Lathrop Ave., Harvey, Ill.

We Also Build—
Electric Traveling Cranes—Cupolas—Cupola Chargers—Ladles—Brackelsberg Furnaces—Air Furnaces—Steel Converters—Dust Filters—Quick-Anneal Ovens—Tumbling Mills—Stokers for Core Oven Firing—Pulverized Coal Equipment.

WHITING
PIONEERS SINCE 1884